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A JOURNEY IN NORTH-WESTERN ARABIA.*

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During the last twenty-five years our knowledge of the interior of Arabia has not been increased in any way. Although Arabia still possesses the largest tract of unknown country in the world, it has been neglected by travellers, and its exploration has been at a standstill for a quarter of a century. In 1908, however, Captains Aylmer and Butler opened up new ground in Northern Arabia, filling in a long existing blank between Bagdad and Jauf. Mr. D. G. Hogarth's paper in the *Geographical Journal* for December, 1908, also drew attention to the remaining fields of exploration in South-Western Asia, and more especially in Arabia. I therefore determined to make an effort to travel over and map out the blank that exists between the Hejaz railway and the Wadi Sirhan, to determine the western limits of the Great Nafud, and to visit the oasis of Teima. Thence I proposed to proceed to Hail, and if possible to follow the Wadi el Rumma down to its junction with the Euphrates river. Teima attracted me because it had not been entered by a European for twenty-six years, and the interest of Hail lay in the fact that there is no up-to-date account of the affairs of the rival Emirs of Hail and Riad, nor of the present state of Nejd.

In January, 1909, through the medium of the American College in Beirut in Syria, I obtained funds to enable me to plan an expedition in search of rare animals that inhabit the northern frontiers of Arabia. In fact, I might almost say that it was a rare antelope, namely, the Arabian oryx, which induced me to launch forth into those inhospitable deserts, and was the "load-star" that led me on across the deserts to the borders of Nejd, in Central Arabia. Although the chief object of my

* Read at the Royal Geographical Society, January 24, 1910. Map, p. 356.

journey was natural history, yet in a land so poor in fauna, I had time and opportunity to further geographical knowledge, and to render an account of these regions in the fullest manner possible.

In January, 1909, I set out from Damascus, and journeyed down the Mecca railway as far as the oasis of Tebuk, on the threshold of Arabia proper. From here I tried to pass into the interior, but found it impossible, owing to the hostility of the Beduin and the watchfulness of the Turkish officials. The Hejaz railway hinders the traveller rather than helps him, for the tribes are hostile to the building of the line, and Turkey has no power amongst the Beduin. Moreover, the pure Arabs of the oasis in the interior are still more watchful, and more determined than ever to stop any but Moslems from entering their "forbidden land."

I spent two weeks at Tebuk. The tribe of the Beni Atiye held the surrounding country, and although I was safe within their borders, I could not go further. So I returned to Damascus to seek an easier method of getting to my goal. My plan of action was to make friends with some powerful Beduin tribe, who could help me on my way into Arabia. In order to do this, it was necessary to find a man to act as guide and friend, and to introduce me to one of the great tribes. Such a man I found in Muhammad Mirawi, a native of Damascus, who had wandered all over Arabia, and had come in contact with most of the great tribes. He had acted as camel-dealer and transport agent for the Haj to Mecca, and had even traded camels from Central Arabia for the Egyptian Government. In fact, being a man of importance, he seemed to suit my purpose exactly, and I engaged him. He was an old man, too old, it seemed, to be setting out on such a journey; but age is greatly respected amongst the Beduin, and his knowledge of the affairs of East and West made him a very superior person amongst the ignorant nomads, who, however, always have a thirst for knowledge.

In Damascus I bought up camel-saddles, water-skins, and such food as rice, flour, coffee, and sugar; rifles and cartridges for my men, and a few presents of clothes for the Beduin. In fact, I bought everything I needed for a journey in a foodless and waterless country. It was necessary for me to change all my money into the Austrian dollars (the Maria Teresa), which are in demand all over Central Arabia in preference to the Turkish money. My only need then was transport, and this I could not get except among the Beduin, for I wanted dromedaries of the finest breed. Thus I had to introduce myself to one of the great tribes that hold the borderlands, and own large herds of camels. For without these a journey into the waterless interior would be impossible. I chose for my purpose the tribe of the "Beni Sakhr," or "Children of the Rock," who hold the marches of Palestine and Arabia. Hearing that they were wandering in the neighbourhood of Katrane, which was an old blockhouse on the Haj route to Mecca,

and is now the position of a station on the Hejaz railway, I made use of the train as far as the village of Jesi, some 40 miles to the north of the former place.

Jesi is situated about 22 miles due east of the Dead sea, in the Belka country, and is of interest as being the limit of cultivation. To the east of this all is desert. This country is a transition stage between the "desert and the sown," the rolling downs are covered with a certain amount of growth, and in the spring there is very good pasturage. Indeed, all the year round there is sufficient to support large herds of camels and flocks of sheep and goats.

The "Belka," then, is the headquarters of the Beni Sakhr, and from it they get their strength and wealth, for they have a good land to fall back on, with a certain good supply, and are not dependent on the open desert with its shifting and uncertain pastures. This is their base, where they can keep their herds in safety and without fear of loss from drought, and it is from here that they range over the country to the eastwards.

The "Beni Sakhr" tribe have the reputation of being the boldest robbers, for their numbers are great and, being rich, possess good rifles, therefore I thought it prudent to make friends with the strongest tribe. The exact range of the Beni Sakhr is from the Druse country south of Jebel Druse to Maan. The declivities of the Jordan valley and the Dead sea form their western boundary, whilst eastwards they wander as far as the Wadi Sirhan. South-eastwards they occasionally make use of the Sherrarat country, with which tribe they are allies, but their migrations in that direction are limited by the territory of the Howeitat, their most deadly enemies. The Beni Sakhr are true nomads, in that they do not cultivate, and always live in tents; but they are of a less migratory habit than the tribes, such as the Roala and Sherrarat, who wander over the inner deserts.

On my arrival at Jesi, I found that the Beduin were encamped in the country to the south-east, and with the aid of a party of Arabs going out to join the tribe, I eventually found myself, after a journey of thirteen hours, drawing within view of an immense encampment of Beduin. There were probably a thousand tents scattered over the boundless waste, pitched in long lines in the wadis, or in any slight depression which would protect them from the wind. Over the surrounding country immense numbers of camels wandered, herded by half-naked Beduin boys. I sought the tent of the sheikh, Hathmel ibn Zeben, who proved a good friend, and showed true Arab hospitality by entertaining me and my men for three weeks.

By living with the Arabs, doing as they did, and moving with them in their migrations, I obtained an insight into their mode of life and customs, which helped me a great deal during my subsequent journey. I found them most friendly and willing to help, but I kept

from them my real intentions, and only told them I needed to purchase camels for a journey. Things move slowly in the East, and I spent fourteen days in buying three camels! But the time was not wasted. I studied Arab manners, learned more or less how to eat with my hands, and how to wear Arab costume with some comfort, how to drink coffee *à la* Arab, and, most difficult of all, how to sit still all day long doing nothing. I found this last most trying, more especially because it was cold; a Beduin tent is a draughty place at the best, but in mid-winter it is almost unbearable. On two occasions there was snow on the desert.

We used to feed out of a huge round dish, ten of us at a time. The fare was camels' milk and bread in the morning, and in the evening we generally had meat and rice, cooked with an enormous amount of fat. During the day we appeased our hunger by sipping strong black coffee. At night there was always a large group of men in the tent of the sheikh, and talk was carried on far into the night. The vexing question of pasture had always to be considered, and when and whither the tribe should move. Small matters and tribal quarrels had to be settled, and there was never a day but news came in of the raids and warfare of the other tribes, news of the rival emirs in the heart of Arabia, and of the fighting between Turk and Beduin along the Hejaz railway.

My man from Damascus was most popular at these evening discussions, for he always had some story to recount or some news to tell, and if ever there was lull in the conversation, he would be turned on to describe adventures he had met with on his travels. Eloquence is a highly prized talent amongst the Beduin, and not only would they recount their stories in the most beautiful manner, but on occasion, to the tune of a single-stringed violin, they would sing extempore songs for hours on end.

One day, when in our wanderings we happened to camp near some rolling country, the sheikh and I rode off in search of gazelle. We found a large herd, and being mounted on good horses we managed to ride them down, throwing ourselves off our horses for the shot, then galloping on again. We killed six gazelle in about an hour, and rode back to camp with enough meat for a big feast.

It is the custom that whoever kills game should provide a feast for all his friends. On the occasion of these feasts I noticed that there was always a crowd of hangers-on waiting at the end for a scrap of food—half-starved looking boys and ragged men. These were orphans, whose parents had been killed, or men whose herds had been "lifted" by other Arabs, and as a result they were destitute, for the law of the Beduin is "survival of the fittest" in its strictest sense. But the sheikh supplied food liberally, and I noticed that he always looked after the poor and fed the hungry.

THE GREAT TENT OF SHEIKH HATHMEL OF THE BENI SAKHR.

SMALL TENT BELONGING TO THE SHERRARAT BEDUIN.

CAMEL-HERDS AT A WELL.

A BEDUIN WARRIOR (SHERRARAT TRIBE).

The tent that I lived in all this time was the ordinary black "beit," as used by all the nomadic tribes. It is interesting to note that the same name is used for "house" in the settled districts, a remnant of the time when all the Arabs were nomadic. The tents varied in size, but not in design. The poor Sherrarat had tiny little tents scarcely big enough to protect two people from the sun and wind, for they were nothing more than screens to shield the owners from the elements. An average tent measured perhaps 20 yards by 6 yards, but the tent of the sheikh was a structure that spread over a length of 36 yards by 8 yards deep. The colour was always dark chocolate-black, the back only being striped longitudinally with white. All the tents of the Beni Sakhr were like this, but the little tents of the Sherrarat were of a greater mixture of colour. The large tents were all divided across the middle by a brightly coloured curtain to partition off the women's quarters. In all cases the front of the tent is open the whole length. They are pitched facing to leeward, and if the wind changes round they merely take off the back and put it up on the other side, thereby changing the front of the tent.

This tribe owned immense herds of camels, a large number of sheep, and sufficient horses to mount all their fighting men. They live almost entirely on the produce of their herds, and have but little need of money. The camel provides them with meat, milk, clothes, house, and transport. Their whole lives are given up to the breeding of their flocks and herds, and to systematic robbery. The Beduin lives in his tent for a week at a time, or until the fit comes over him, and he calls his companions, and off they go on a foray to steal camels, in order to increase their own herds. The Arab's great idea is to possess a rifle, for that means power. In order to do this he must steal camels. So, having stolen camels, he purchases a rifle; then come more raids to take more camels, this time in order to buy a wife. Camels are their sole means of exchange.

During this time we constantly changed camp, and wandered across the desert in search of new pasture, for the grazing was not sufficient in any one place to support the herds of camels for any length of time. At dawn I used to find the camp astir, and the tents being taken down by the women, and rolled up into huge bales, while the boys herded the camels, and the men loaded them up with the household impedimenta. When the camels were laden, the small children were lifted on to the top of the loads, where they seemed perfectly at home. Then, when all was in readiness, the migration began, and each family, with its own compact little caravan, set off across the desert.

One by one each little home was packed up, and moved off to pastures new. First of all went the camel-herds, driven by lads and lasses; these were followed by the camels, laden with the tents, camp-kit, and small children; the women walked by the side, or rode,

perched on the top of a tent-load, singing wild Beduin songs as they moved, heedless of their poverty, but revelling in their freedom. The men, armed and on horseback, rode far in advance or at the rear on the look-out for enemies, scouting the country in search of pasture, sometimes indulging in a course after a hare with their greyhounds, or loosing their falcons at a "houbara" bustard. Hares, bustard, sand-grouse, and gazelle abounded on these rolling plains, and I saw many a pretty hunt with hound and hawk.

It is a fine sight to see a large encampment on the move, imbued with the spirit of "divine unrest." The Children of Israel must have presented just the same spectacle when they wandered of old from well to well, for the Arab never changes. When the chief finds a suitable grazing-ground, he lights a fire as a signal to the rest of the tribe, who are scattered over a large stretch of desert. The smoke of the fire shows the nomads the position of the chief's tent, and they gather round and pitch theirs in groups, generally in depressions to get shelter from the wind. It takes very little time to put up the tents and to get everything in order, and then the Arabs lie about and talk and drink much coffee, until the spirit moves them to go on a foray, or necessity forces them to shift camp again.

One evening the monotony was varied by the scare of an attack by a hostile tribe, and the news was passed through the camp in an incredibly short space of time, the cry for horsemen being taken up from tent to tent. The whole camp was in a turmoil in a second. Every man who owned a horse, or who could borrow one, armed, mounted, and galloped off, the women standing at the tent doors to wave them farewell. Men who had no "mounts" went on foot, and the boys were busy herding the camels nearer to the tents, for in Beduin warfare the camp itself is never entered, nor are the tents molested. Thus all able-bodied men can go off to fight, and leave the camp without fear of their belongings being pillaged. The scare turned out to be nothing in particular—a passing raiding-party had chanced on our encampment, but had beat a hasty retreat on finding out our numbers and strength.

As of old, the Beduin's "hand is against every man's." They are daring robbers, and think nothing of killing if ought is to be gained thereby. They have, indeed, reduced robbery to an art, and their one alleviation from the dull monotony of life is systematic robbery. These desert-rangers correspond exactly to the polite highwaymen of our own English high-roads of a hundred years ago. They are always spoiling for a fight, and the young Beduin, who are at all ambitious, find this their only means of becoming powerful.

A rifle is the wish of every young Arab, and, when he has got this, he enters on a career of plunder, in order to possess a good number of camels. Every Beduin in Northern Arabia owns a breech-loading

rifle. I examined a great number of these, and found them to be chiefly of British manufacture. There were also a fair number of American rifles, and a few French.

I seldom saw a Beduin praying; in fact, they seemed to me to be utterly careless of religion, and it is certainly remarkable that, although Arabia is the centre of the Moslem world, yet a third of its inhabitants care nothing for Islam. The nomads are not religious, and never were; they would rob a Mecca pilgrim as readily as they would a Christian. Mohammed never converted the nomad tribes.

During my stay with the Beduin I had been endeavouring to buy good camels for my journey. The remark that I wanted camels drew out long stories of record rides, and extraordinary distances covered without water, arguments as to the best breeds of dromedary, and their respective qualities. Camels form the chief concern in the Arab's existence, for, as I have said, they supply him with all his wants, and even his wife is purchased by means of camels. Hence the breeds are well selected, and the pedigrees carefully kept. There are several well-known and highly prized kinds, and I endeavoured to obtain the best, for my journey was to be of the severest nature, and if the camels fail in a waterless country, the results are apt to be disastrous. Many camels were brought to me, but most of them were refused, for I had an expert buyer to bargain for me who knew all the tricks of the trade, and so one by one three well-bred female dromedaries in the finest condition were bought at a cost varying from £11 to £16 apiece.

By this time I calculated that my position was about 20 miles east of Katrane. All the country to the east was unknown, and I saw that by making this my "taking-off" place, I should break new ground to the borders of Nejd, in Central Arabia. It is true that an Italian, named Guarmani, passed this way on his way to Nejd some forty-five years ago, but his account of this region is very vague. His route lay to the west of mine, and although he described in detail the tribes he met with, and his narrow escapes from marauding Beduin, of geographical information he gave us very little indeed.

This country has also been described by Tristram, who in 1872 reached the Haj route near Khan Zebib, during an exploration of the Land of Moab. He ventured no further, but described the unknown deserts to the east by hearsay, "After three days' journey across the White or limestone country is a region of black basalt, 'a land of black stones.' This he describes as being two very long days across, and he thinks, but is not sure, it is about three days' journey from north to south; this volcanic region he calls El Hhurreh. Beyond this black stone country eastward are two days more of white ground, hilly, but with good camel pasture, and then begins a desert with nothing on it but antelopes and wild cows."

A new difficulty presented itself at this moment: I could not persuade

any Beduin to accompany me, and act as guide across the waterless desert that I now had to face. One and all refused on the grounds that I was a Christian and therefore certain to be robbed, and that, if any harm came to me, they would be accused of having had a hand in it. At last, with great difficulty, I induced the chief to give me one of his own men, a huge "Sherrari" of the Sherrarat tribe, who eventually proved invaluable.

My arrangements being completed, having packed my goods into sacks, filled my four water-skins, and watered the camels for the last time for many days, one evening after dusk the four of us mounted on four camels, left the homely tents of the "Beni Sakhr," and set out into the night. We travelled far that night, in order to get across the danger zone that exists along the coasts of the desert sea, sleeping for a short time before daybreak, after which we pushed on again, and rode all day.

I now kept my observations as best I could, with compass and watch, noting every hour I rode, as well as the pace and direction. On camels one travels very straight, and at a very even pace, making a perfectly straight line across the boundless desert, from horizon to horizon. During the first day's ride—that is to say, at about 45 miles east of Katrane—a remarkable change took place in the nature of the country. (I use this place as a base from which to count my distances, for it is the only place near my starting-point that is well marked on all maps.) The limestone steppe changed to black desert, the rolling country, bearing a certain amount of growth, suddenly stopped, and before me was an immense smooth plain covered with rounded flints, destitute of vegetation except in the wadis. The small amount of animal life which was to be seen in the "Belka" country here became still less. No gazelle or bustards enlivened the dreariness of the scene, but there were a few small birds, and occasionally I started desert hares.

There is a good landmark for travellers, which also serves to mark the junction of the limestone and the flinty deserts. It is a group of three little hills, standing up out of the desert, and visible at a long distance—"Thleithuwath" the Arabs call it. To the north of this is another small ridge which the Arabs have named "the end of the flints," for Arabians from the far interior, coming up to Damascus, here leave the black stony desert, and arrive at a less forbidding type of country. Then followed several hard days of travel across the black desert called "Ard-es-Suwan," or "the desert of flints," by the Beduin. I steered a course south-east by south, and kept a very direct line.

The nature of the country was that of a wide plain, gently rolling in great folds, which, however, looked perfectly level as a whole. It was a smooth limestone floor, sprinkled over evenly with countless flints, worn smooth by the action of wind and weather, polished and glistening in the sun. Here and there sandstone spires and quaint pyramidal hills, which served as landmarks, stood up out of the desert. This great

THE "ARD-ES-SUWAN," OR "DESERT OF FLINT."

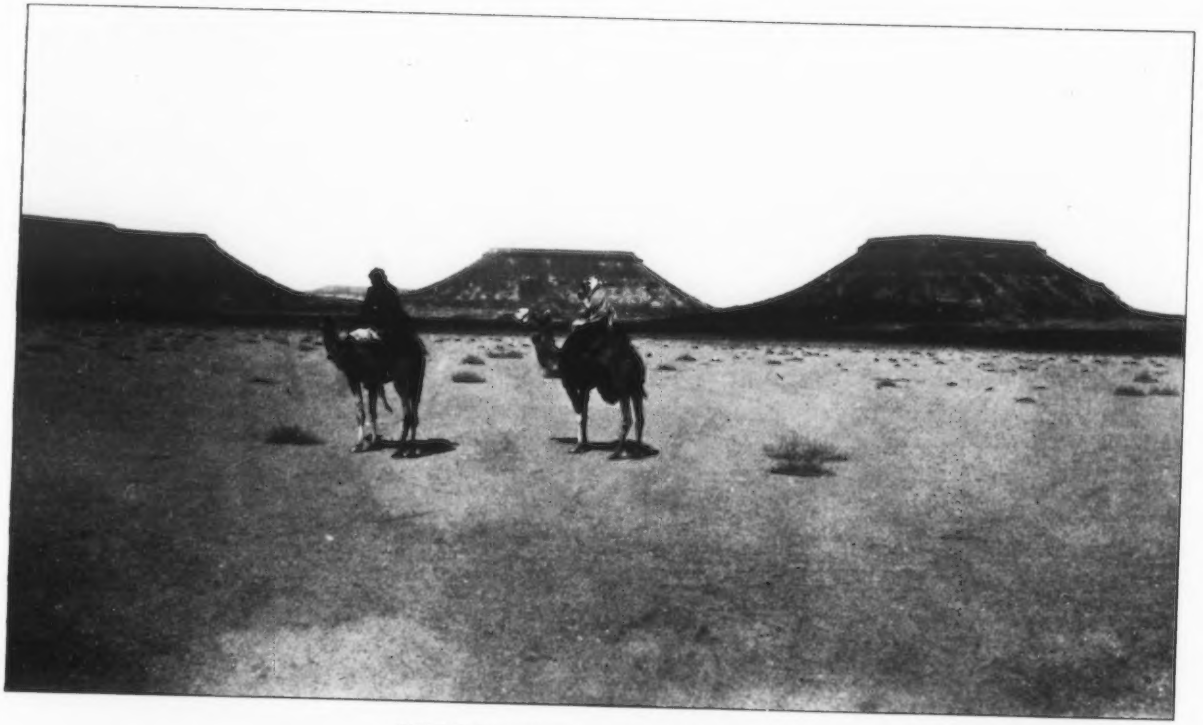

TABLE-MOUNTAINS IN THE "ITBAIK" REGION.

black desert is not entirely featureless. The Beduin have names for every physical feature, every wadi, pasturage, and depression, every little hill and curiously shaped rock—all are considered worthy of name and notice. The altitude was high, for day after day my aneroid registered above 3000 feet, and there was very little variation in the altitude for the first five days.

The line of demarcation between the limestone and basalt deserts also marks the limit of that country where dew falls and where it does not. To the south of Wadi Bayer, the Beduin say, no dew falls, and I can testify that during the whole journey I slept out in the open and never found my clothes in the least damp.

There were many wadis intersecting my route, all of which trended in a north-easterly direction, and all flowed to the Wadi Sirhan. Three of them were especially large and important wadis, namely, Wadi Bayer, Hausa, and Hidrij, composed of deep steep-sided watercourses, and containing a considerable amount of vegetation, tamarisk, and thorn-scrub. In the dry water-channels were piled up heaps of dead wood and old trees, washed down by sudden floods. Although this land appears so sterile and rainless, yet sudden storms occur, which fill the wadis to overflowing, and cut deep channels. In these wadis is collected all the animal life that exists, and I found innumerable colonies of sand-rats, which honeycombed the ground to such an extent that the camels sank in up to the knee-joint. These I trapped at night, for we generally slept in the wadis, and I used to skin them as I rode along the next day on camel-back.

I should much have liked to stop and collect specimens of all the fauna that inhabited this region, but lack of water forbade it, for I only had sufficient for six days. The few birds to be seen were the desert scrub-warbler (*Scotocera inquieta*), a chat (*Saxicola leucopyga*), two species of larks (*Calandrella brachydactyla* and *Otocorys bilopha*), the raven, and the ostrich. This last was an interesting discovery, for no traveller except Palgrave has mentioned sighting them in Arabia, although they have been reported by the Beduin. Presumably it is the same as the North African variety (*Struthio camelus*), and its occurrence in Arabia is an interesting example of a genus peculiar to Africa ranging into Asia. I saw three in the Wadi Hidrij, which is, roughly, 120 miles south-east of the Dead sea. They are found all over the interior of Arabia, but this is probably their most northerly limit. Ravens seem to find a living in the most desolate localities, and on one occasion a pair of these birds followed us, as we travelled, for a whole day across the desert, stopping when we stopped to eat, picking up the crumbs after we had left, and then following on behind.

For six days we never saw any signs of human beings, but that this region is crossed and recrossed at certain seasons by large numbers of Beduin, is evident from the well-defined tracks that mark the

desert. The surface is hard and strong without any sand to blow about and cover up traces of footprints, and at the same time it is too hard to take an impression easily, yet the desert is tracked in all directions by smoothly worn paths, which are probably of an immense age.

To show the immensity of this land and the ease with which one could lose one's self, I may mention that we had to travel a whole day's journey without in the least knowing where we were, until my guide could pick up his bearings. Then he sighted a hill shaped like a camel-saddle just showing above the horizon, and knew our position exactly. At night we travelled by the guidance of the stars, for it was often necessary to push on at night as well as in the day. My usual plan was to travel from sunrise till eleven o'clock, then rest for two hours, and travel again till five in the evening, when we took a meal and rode on for a couple of hours in the dark before stopping for the night's sleep. I never used a tent, there was no need for it, the climate was perfect. I always slept as the Arabs did, on the ground, wrapped up in a sheepskin coat, beside my camel.

The camels during this trek had no water, of course, and very little to eat, for they never had more than two or three hours to graze every day, and there was not always sufficient to eat. This is the reason why the best camels in the finest condition at the outset are an absolute necessity. I repeatedly took these camels for periods of six and seven days without water. Nine days is the recognized limit in Arabia whilst travelling, but herds out grazing in the spring months will go for a much longer period (three weeks, it is said). In the colder climate of Central Asia the Bactrian camels will endure for nine days. I mention this because there seems to be much misapprehension as to the abilities of camels to exist without water. A recent writer in the *Times* states that "in Arabia the breed (of dromedaries) appears to have deteriorated, for here they will thirst perhaps for three days, after which they die, protesting. . . ."

On the sixth day after leaving the tents of the Beni Sakhr the black desert ended, and I entered a region of sandstone. The whole aspect of the country altered, and before me stood a prominent range of hills, where water was said to exist, and our water-skins being empty we hurried on. The wadis now drained to the west instead of to the east into Wadi Sirhan, and I eventually found a large depression situated north of the hills called Itbaik, to which they all flowed. The well was situated in a wadi called Hausa, which is surrounded by steep hills, an outlying spur of a more extensive range further on.

Wells in such a country as this rank as a most important feature, for they make possible the existence of a large nomadic population. One well in a waterless region will support any number of shepherds, and will enable them to use as a grazing-ground a country which would otherwise remain uninhabitable for lack of drinking-water. I found

the well of Hausa to contain the most excellent water at a depth of 40 feet.

We watered our camels and filled our water-skins as quickly as possible, for the wells are still the most frequent causes of quarrels, as in the days of old. But, quick as we were, we had an exciting moment when suddenly four Beduin appeared riding down on us in a threatening manner. They called on us to stand and deliver. But we, being the stronger party, were on the point of firing, when my guide suddenly recognized his own tribesmen, and all was well. The next minute the Beduin were kissing each other. The robbers were of the Sherrarat tribe, scouting the country on the look-out for plunder. If I had not had a man of their tribe with me there would have been a fight, and somebody, probably myself, would have lost his camels, and been left stranded in the desert. An ominous number of graves dotted the ground around the well, showing where others had been less fortunate.

In the neighbourhood of this well I saw much game. The hills were inhabited by many ibex (*Capra sinaitica*), and I saw some carrying very fine horns. Gazelle also were numerous here, and seemed to prefer the hill country to the open desert. I found tracks of the "cheetah," and came on the first clear traces of the Arabian oryx (*Oryx beatrix*). I left the well and went some way to the south-east, where I camped in order to hunt the surrounding country. The whole of this region belongs to the Sherrarat tribe, but, not being powerful, they are unable to hold it against strangers, with the result that many Beduin range over this area and render the country unsafe. It is neutral ground where many a fight takes place. Four great tribes wander round its borders, the Roala and the Beni Sakhr on the north and north-west, the Shammar on the east, and the Howeitat on the south-west. The Sherrarat, in order to save themselves from constant harrying by these stronger tribes, have become allies with them. Whenever I came across Beduin of the above-mentioned tribes, I found small encampments of Sherrarat pitched alongside of them. They are the poorest of the poor, and their tents are nothing but a shelter from the wind and sun, sometimes not sufficient to protect the whole family at once. They are fine hunters, however, and excellent shots, as their country is full of game. They also have the peculiarity of being mostly left-handed.

There are evidences to show that the interior is becoming more dry, and as a natural result the nomads find it more difficult to support themselves, and are therefore dwindling in numbers or seeking the protection of the semi-nomadic tribes who live on the edge of the cultivated lands. It is said that the Sherrarat were once a large and powerful tribe, and that their country was a "good land"; but the drought came, their herds died, and their country, which was once good pasture-land, became dry and useless. This they told me themselves, and went on to

say that, as a result of the prolonged drought—it lasted seven years—their tribe divided, and the greater part migrated to Tunis. I asked them when that was, and they said, "In the days of Mohammed." This remark seems to be of the greatest interest, for it is evidence as to the desiccation of Northern Arabia. The date they gave me, the days of Mohammed, would be about 600 A.D., and this corresponds with Prof. Huntingdon's conclusions as to the desiccation of Central Asia, namely, that the period from 300 A.D. to 800 A.D. was the time of the greatest desiccation and lessening of the rainfall, which caused the western migration of the inhabitants of those regions.

Such a drought as this would affect the Sherrarat more than the other tribes, for the Sherrarat hold a region which is wholly desert. Without large wadis, where there is always pasture or oasis, they have nothing to fall back on, as the Roala have in the Wadi Sirhan, or the Beni Sakhr in the Jordan depression. Lady Ann Blunt also tells of a legend she heard in Nejd, to the effect that there was a great famine in Arabia, and the tribes migrated to Tunis.

I now reached a most interesting region called "Itbaik," which I am of an opinion is the same as the range of hills mentioned by Doughty on hearsay. He called it "Tobeyk," and it is placed somewhat vaguely on the map, rather to the north of its real position. He described it as being as high as the Irman mountains in Nejd, and as being snow-covered in winter for a considerable time. I found it to be a sandstone range, with erupted basalt rocks on the desert at the foot of the hills. The hills were a mixture of sandstone, worn black by weather, and of lava-capped sandstone piles, all of which had the appearance of flat-topped table mountains. Some of these were perfectly black, and looked like immense cinder-heaps, while others were of red sandstone, with only the lava-cap showing black at the top.

The range ran east and west. Towards the east it soon faded away and was lost in high rolling country of sand-dunes and sandstone rocks; to the west it rose up, and appeared to culminate in higher peaks of about 4000 feet. At the point where I crossed the range my aneroid registered 3600 feet. In the valleys and among the hills the ground was silted up with red sand, and there was much less vegetation on the south side than on the north. In this region of sands appeared the first "ghada" bushes, a species of salsola, which grows all over the inner sand-desert of Arabia. I think that this range of Itbaik is continuous with the ridge which borders the Hejaz railway on the east, and possibly with Jebel Sherora, that one sees to the north-east of Tebuk.

Leaving the hill country, and dropping again on to desert, after two days I found the wells of Mghairah. These wells contained good water, but of a very red colour; it was not far below the surface, and there were many well pits. Here I fell in with the main section of the Sherrarat tribe. Some two or three thousand camels were driven in to

A BEDUIN OF THE SHERRARAT TRIBE.

WIND AND SAND-WORN ROCK, WEST OF THE GREAT NAFUD.

HOUSES IN THE OASIS OF TEIMA.

AN ARAB OF TEIMA.

be watered at the wells. I was struck with the extreme poverty of these Beduin, for their tents were miserably small, their food was abominable, and the sheikh did not even have any coffee. They possessed some black camels—the first I had seen—and they also had some exceedingly fine white dromedaries. The Sherrarat are considered the most skilful hunters, so I tried to persuade a hunter to accompany me, but they all seemed afraid to go in the direction I indicated because of the Howeitat tribe, who were out raiding.

At this encampment I was paid the greatest compliment that can be offered to any stranger. A young camel having been killed for the evening meal, the women collected the blood in a bowl, and, with a switch of dry grass, they painted long streaks of blood on the necks and flanks of my camels. In the dry climate the blood remained on for a very long time, and acted as a talisman amongst all the Sherrarat Beduin. In this camp I saw the strange sight of a camel carrying large saddle-bags, in one side of which were two babies, and in the other a baby camel!

"Man wants but little here below," but the Sherrarat have reduced their wants to a minimum. A Sherrari I engaged as a hunter possessed nothing in this world except his camel, saddle-bags, rifle, and the clothes he stood up in. He travelled with me for a long time, and never even had an extra covering at nights, although the weather was terribly cold.

The Sherrarat are all very good shots, and it is a common saying amongst the other tribes that a Sharrari is equal to three other men in a fight. Their skill in tracking is also very great, for these nomads, like the Red Indians or the Hottentots, have reduced the practice of tracking to a science. Half the life of a Beduin is spent amongst the camels; from early childhood, when he is sent out to guard the herds, until he is too old to ride out on raiding expeditions, camels form the chief concern of his existence. They are herdsmen by profession. Without the camel, life would be impossible in the deserts of Arabia. Small wonder, then, that camel-talk is as interesting to the Arab as the camel itself. It is his only means of information, and, by constant practice, the true Beduin can read the footprints like a book; they are science and gossip to him. This art is called Athar.

On several occasions when travelling by night my hunter stopped his camel, and, after a short examination of some camel-tracks, exclaimed that it was a raiding party of such a number and of such a tribe, and on each occasion I proved him correct. In daylight he could determine the exact number of camels from a mass of tracks all going in one direction, and could also say how long ago they passed and to what tribe they belonged. Marauding bands always leave a long, straight, compact line of footprints, as of men travelling fast, close together, and with an object. On hard, stony ground, where the camels leave little or no

impression, the dung tells exactly the time at which the owners passed that way, and probably the nature of the pasture, from which they deduce the extent of their wanderings.

Another most interesting custom of the Sherrarat is their habit of fortune telling. On every possible occasion, when in doubt as to the way, in danger of marauding bands, in want of water, or even when hunting and are in doubt as to the age of an antelope track, they proceed to tell their luck before venturing. It is simply done, by smoothing out the sand and making at hazard several rows of marks in the sand with the fingers. An even number is a bad omen, an odd number a good.

On leaving the wells of Mghairah a new type of country faced us. This was the region immediately west of the Great Nafud sand-desert, where I entered a very weird area of wasted sandstone hills. It was as if the whole country had been swept away by the continual westerly winds that always blow here with great violence. The ground was covered with wind-worn rocks that stood up in hundreds like giant mushrooms. In other places the dominating feature of the landscape was the table-mountains. These are of volcanic core, but outwardly appear to be sandstone. They are black at the summit, whilst the sides are red. Long ages ago the whole desert was at the same level as the top of these hills, but the continual wasting away and drifting of the sand towards the east has lowered the level of the country, and only the hard volcanic spires remain. The result of this wasting has gone to make the great sand-desert that has formed in the centre of Arabia, and which is called "Nafud." The true "parents of the Nafud" are, however, further west than this—the high ranges of wasted sandstone that border the Hedjaz railway.

Passing to the east of the well of Fajr, and safely through a mixed encampment of Roala and Sherrarat, I entered on the last stage of my journey before reaching the first oasis. The land became more barren. There was scarcely any camel-feed at all, neither had I any success at hunting, although I followed one herd of oryx for three days. We found on one occasion the traces of a fight between the Shammar tribesmen and the Roala, which showed that we were getting within the boundaries of the Emir of Hail.

To show how complicated are the intrigues of the various tribes, I might say that the Roala Beduin are enemies with the people of Teima and with the Shammar tribesmen, and yet they are friends with the inhabitants of the oasis of Jauf, who are themselves adherents to the Emir of Hail, and indirectly with the Shammar and Arabs.

On the eighteenth day after leaving the tents of the Beni Sakhr I sighted the oasis of Teima, the first town of any importance in North-Western Arabia. The oasis formed a large patch of cultivation in a glaringly white and absolutely sterile basin. We rode down and boldly

entered the oasis, being entertained by one of the leading families, relations of my Damascene friend who accompanied me.

So far everything had gone well, and I had passed through the Beduin tribes without hindrance, but I had yet to deal with the fanatical settled population of the oasis of the heart of Arabia—the pure-blooded Arabs. My intention was to remain in Teima until I could procure guides and protection for my journey to Hail, but my plans were suddenly upset by the Governor of Teima ordering me to leave the oasis immediately. He also sent his armed servants to turn out all my baggage, and to rob me of all the money they could find. This they did. Finding me quietly sitting in a tent pitched in a garden under the palms, they covered me with revolvers, tore open all my baggage, and took everything that they fancied. They did not find much, however, for I had already taken the precaution of stowing all my valuables in the harem of my host's house, where everything, in Arabia, is as safe as in the Bank of England.

However, on one pretext or another, I managed to remain in Teima five days, in spite of daily warnings from the governor to "quit." He also made insinuating remarks to me as to the fate of the last European who visited their town—Huber—who was here in 1863, and was eventually murdered.

Although the governor, the representative of the Emir of Hail, behaved thus, the inhabitants were, on the other hand, quite friendly. My host proved his Arab hospitality to the fullest limit, and was willing to endanger himself rather than turn away a stranger who had come to his house.

The chief impressions I gathered of this ancient oasis were, the extreme cleanliness of the houses, the great size of their halls, the wonderful water-supply, and, I might also add, the beauty of the women. The halls are of such a size that when occupied by twenty or thirty men they still look empty. The rooms are high and lofty, with roofs of palm or tamarisk rafters, often supported by rows of pillars. I measured one room 40 feet by 30 feet, and 20 feet in height.

The chief sight in Teima is the great well-pit, the El Haddaj, rightly called the "Heart" of Teima, a well famous all over Arabia. It is of such a size, and so great is the flow of water, that ninety camels can draw water at once. By a clever system of skin-buckets and ropes passing over ninety pulley-wheels, this number of camels can work at the same time. Automatically the water is tipped out into stone troughs and is carried to the furthest corners of the oasis by irrigating canals. Day and night the water is being hauled up, and the constant creaking of the water-wheels resounds all over the oasis. Besides this well, there are at least twenty smaller sources.

This water, the natives say, comes from the volcanic country called Harra. It is without doubt a strong spring of pure artesian water,

which they have chanced to tap, which would otherwise flow unused all the way to the Persian gulf. There is apparently a great deal of water flowing across Arabia, but secreted in the sandstones far below the surface and hidden under its burning sands.

In the depression of Teima the water lies nearer the surface, and is therefore more easy to get at. By means of the water thus made use of, the inhabitants grow the following crops: barley, wheat, and a small quantity of millet; they cultivate the plum, fig, lemon, pomegranates, and gigantic citrons. Grapes they grow in small quantities, and, curiously enough, tobacco—a strange product for an oasis generally considered strong adherents of the Wahabi sect, whose tenets forbid them to indulge in luxuries and the use of tobacco. Dates, however, form the staple food of the inhabitants, and these seem to reach as near perfection as possible in this oasis. The date-stones are ground up and used for camel-food.

Another industry of Teima is the collecting of rock-salt, which is in general use amongst all the tribes of Northern Arabia.

The inhabitants of Teima are of the purest Arab breed, and very handsome in appearance. They appeared to me of almost a pale complexion after the Beduin, but this is not to be wondered at, seeing that they seldom leave the shadow of their palm trees, and never have to endure the burning glare of the desert. The men wore their hair in long curls, or in plaits, and they always shave the upper lip in orthodox Moslem manner, but as a rule they had scanty beards. Their dress varied but little from the Beduin, except that they carried swords instead of rifles. These scimitar-shaped swords were of fine workmanship, made at Hail, and the owners carried them constantly wherever they went. The natives seemed to me to be extremely suspicious, and zealous of guarding their oasis from intruding strangers, and they are just as suspicious of the Turks as of the Christians, especially now that the Hejaz railway passes within a two days' journey of their town. That the oasis of Teima is increasing in size is evident from the new plantations of young palm trees that are appearing on the outskirts of the older cultivation and the new walls encircling them. There is no reason why Teima should not increase in prosperity, for the water-supply is unlimited. The aneroid read 2800, 2900, and 3000 feet whilst I was in Teima, though Mr. Doughty makes it 390 feet higher than this.

It seems impossible to give any estimate of the size of Teima, for there is no large block of houses or bazaar. Each man's house is situated in its own garden, surrounded by a high wall. At the time of my visit—the end of February—spring was in evidence at Teima. The plum trees were in blossom and the figs in leaf, and I also noticed many small birds on their northern migration.

Of the affairs of the Emirate of Hail I heard but little. The present

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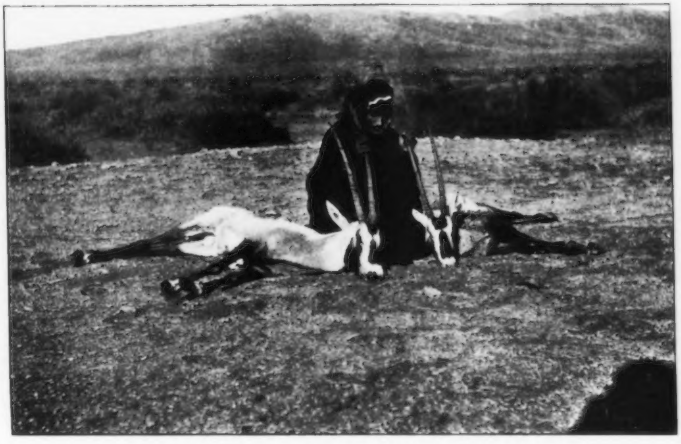
SAND-DUNES IN THE WESTERN NAFUD.



THE ARABIAN ORYX (*ORYX BEATRIX*), THE "WILD COW" OF THE BEDUIN.

Emir was a child of twelve years of age; at that time the country was being ruled by his uncle Hamud ibn Sebhan. While I was in Teima this man was killed, and no doubt sleeps with his fathers, whilst his cousin Zamil ibn Sebhan rules in his stead. Of the rival emirs, Ibn Soud was at that moment the stronger.

After five days the attitude of the governor became very threatening, and since I had no guides to accompany me to Hail, and the tribes in that direction were in a more unsettled state than usual, owing to the murder of their leader, I left Teima. Escaping by night, I struck due north and explored the western edge of the Nafud. The southern edge of the sand-dune area has been skirted by a few travellers, but its western limits were unknown.

Passing along its western edge, I determined the limit of the sand-dunes in this direction to within two days of the oasis of Jauf. The dunes begin in a most remarkable manner, rising up abruptly above the surrounding desert, so that one can walk in a few paces from the hard stony steppe on to the wild turmoil of sand-hills. At the edge of the dunes, half-way between Teima and Jauf, the aneroid registered 2300 feet, which corresponds exactly with Blunt's observations at the Nafud edge near Jauf. Mr. Doughty's readings on the edge of the dunes between Teima and Hail are much higher than mine, namely, 3495 feet. This greater altitude is accounted for by the fact that the general slope of Arabia is from the south-west to north-east, and that therefore the highest part of the floor of the Nafud is in the region where Doughty took his readings; also the sands themselves lie deeper on the south and south-west than they do on the north and east.

The sand-dune area itself is at a higher altitude than the bordering steppe, and one immediately rises on entering the sand-hills. The aneroid registered 2300 feet on the steppe, and 2600 feet on the first sand-ridges. Euting gives 960 metres as the altitude of the highest sand-dune, and Doughty makes a difference of 575 feet between the steppe and the sand-dunes. Thus the dunes stand up above the true level of the desert to a height of from 300 feet to 500 feet.

The sand-dune area, curiously enough, supports a considerable amount of vegetation, a heavier growth, indeed, than the surrounding desert. The Nafud is covered with the ghada bush, and a tall grass, called "knusi" by the Arabs (*Aristida forskahlei*), grows in some quantity, and is excellent feed for camels. There are also wide stretches of pure sand without growth. I have measured the roots of the ghada, where the sand has blown away and left them exposed, as 50 feet in length. I also found a curious parasite (*Cynomonium coccineum*) growing on the roots of the ghada bush, which produced a long spadix of the most brilliant red colour. As these are very juicy and full of water, the antelope that inhabit this waterless region dig in the sand in order to

get at them. It is worthy of notice that the Arabian oryx seemed to be most numerous where these parasites were growing. Another plant of parasitic habits found there was the *Phelipea lutea*.

All the dunes trended in a north-and-south direction, and the sides facing east were generally too steep for the camels to walk down. The sand was red and of an extremely fine texture, and I noticed that on the tiny sand-ripples the summits were composed of large grains, whilst the hollows were filled with very fine particles. I saw nothing of the curious faljes, or great horseshoe pits, which all travellers have remarked on in the centre of the Nafud. In the sand-desert itself there are no wells, but outside its limits on the west I found three, namely, Ubai, Huj, and Imleih. Only the last named was visited, and I found it to contain rather salt water at a depth of 20 feet. There were numerous well-pits. The well of Huj is between this and the Nafud, and is well marked by a hill shaped like a camel-saddle and called Huj Umkur.

The well of Ubai is also on the Nafud edge north-north-east of Teima. To the east of it there are some sandstone crags emerging out of the sands, called "Theithuwath Assafiyyeh" and "Hulwan Khunfi;" the latter is identical with Thulla Helwen mentioned by Doughty. These hills, like the crags of Jubbe on the Hail-Jauf route, are probably a confirmation of Euting's statement, as mentioned by Mr. Hogarth, that "the sandstone stratum of the Nafud is not infrequently emergent in the form of flat-topped hills."

The Roala tribe were camped in this region, and although I only came in contact with a small section of the tribe, I could not help noticing their superiority to the other tribes I had met. They appeared to be remarkably well to do, owning many horses, falcons, and hunting-dogs, while their tents were very large and their camels were decorated in a way that suggested wealth.

To show that this region is not entirely without rain, I may record the fact that we came across several pools of rain-water caught and standing in hollow rocks. We should have passed them by unnoticed if it had not been for the camels, who sniffed the water from a considerable distance. This water would remain for several days if there was no wind, but with the least breeze it would soon dry up. There was a small encampment of Beduin near by, dependent on these small pools of rain-water for their drinking supply.

Along the edge of the Nafud I found a few more birds, and obtained samples of a chat (*Saxicola morio*), three larks (*Alæmon desertorum*, *Ammomanes desertorum*, and *A. cinctum*), and the cream-coloured courser (*Cursorius gallicus*). On the sand-dunes I found the broken eggs of the ostrich, and many small hares. An extremely venomous snake exists in this region, and I obtained one fine specimen. It is a horned viper of a bright sandy colour. But the most interesting fauna was the Arabian oryx, whose

haunts I had at last found. Here on the western edge of the sand-dunes they roamed in considerable numbers, and I carried off with me five entire skins of these antelope, which had not previously been hunted by Europeans, nor had they even been seen in their natural haunts.

Leaving the Nafud and turning west, I returned to the well of Hausa, passing on the way the borders of the smooth black plain of Bseita. This is identical with the Albuseita mentioned by Wallin in 1848. Although absolutely bare of all vegetation at the time of my visit, I noticed many little circular threshing-floors, where the Beduin prepare the seed called "semh," which grows in great quantity when there is any rain. The semh plant, according to the Arabs, cannot be reproduced from seed, neither have they ever succeeded in cultivating it. For this reason the Sherrarat call the plant "the gift of the rain." The grain is dried in the sun and ground into flour. This they make into bread, or mix with their dates, or eat as porridge.

The well of Hausa we found to be nearly dry, and, with thirsty camels and empty water-skins, we hurried on, travelling parallel with my out-going track, but on the west of it. This route took me to the wells of Bayer, in Wadi Bayer, where I chanced to fall in with a raiding party of Beduin. They were encamped at the well, on the look-out for Arabs coming in to get water. They at once took my party prisoners, and I should have lost all my possessions if the chief had not happened to be friendly with the tribe of the Beni Sakhr, under whose protection I had set out. I mention this as an example of Beduin chivalry, for the Arabs are still romantic highwaymen rather than bloodthirsty ruffians. They have not degenerated, neither are they illiterate or uncouth, but, on the contrary, exceedingly polite, and have the same powers of eloquence, and the same beauty of speech, which have always distinguished them. These desert-dwellers own no law but custom, and their custom is inviolable.

As a result of my capture by this raiding party, I made a most interesting discovery. The well called Bayer, where the robbers were encamped, is situated in the upper part of Wadi Bayer, some 55 miles east-north-east of the oasis of Maan. Now, this is on the line of the supposed ancient trade route between Egypt and Busra, and, as a proof of such a route having existed, I found at this very well the ruined remains of a large khan, or caravanserai. Such a building as this, far away out in the sterile desert, must denote an ancient prosperity which has long disappeared.

With the decay of Babylonia and the desiccation of Northern Arabia the trade routes naturally fell into disuse. Even the great trade centre of Petra is deserted, and Gerra, the terminus on the Persian gulf, is nothing but a name. Small wonder, then, that the wayside stations have fallen into oblivion.

This, then, is another link in the chain, and we now have an almost complete series of wells across the middle part of this route, namely, from Petra to Jauf. The stages between these two places are as follows:—

Petra to Maan, 20 miles.

Maan to Wokh, about 25 miles. This is a well and ruined village mentioned by Palgrave.

Wokh to Bayer, 30 miles.

Bayer to Weisit, 95 miles. (I should not be surprised if there is yet another well in this region, together with a ruined site, still undiscovered.)

Weisit to Jauf, 90 miles. This stage is through the Wadi Sirhan, where there are numerous wells.

Of the stage from Jauf to the head of the Persian gulf we know nothing, but on the old maps in the atlas of Ptolemæus, I find place-names at regular intervals, as if indicating the stopping-places on a caravan route.

These details will be of interest to those who propose a railway from Egypt to the Persian gulf. No greater hindrances exist than those already overcome by the builders of the Hejaz railway. As a whole the type of country would be easier than that crossed by the Mecca line, and the physical difficulties less severe.

The objection put forward that the Beduin would prove hostile to the building of the railway is, I think, unfounded. On the Hejaz railway this hostility does exist, it is true. It is partly the result of a weak government, but chiefly because the building of the railway takes away from the Beduins the blackmail which they have imposed from time immemorial on the pilgrim caravans, in return for a safe passage through their territory. Moreover, the trouble usually occurs on the threshold of the Holy provinces, and not on the northern deserts.

Now, if the "Suez-Busra" line was built, the Beduin who inhabit the region through which the line would pass, need not be interfered with in any such way. They would not lose their independence through the building of the railway. The Beduin are not unreasoning barbarians, but are quick to recognize a powerful and just government.

The Hejaz railway is not interfered with by the Beduin, except in the neighbourhood of the Holy provinces, and I have myself seen the strange sight of a band of marauding Beduin come in to a station on the line in order to get water for their wounded men and horses.

From the wells of Bayer, which, by the way, consisted of two well-pits about 40 feet deep, containing most excellent water, I travelled fast, until I reached the Hejaz railway at Khan Zebib, which is an old Saracenic castle on the pilgrim route. From here I made my way to

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the tents of the Beni Sakhr, and thence by way of the Jordan valley to Damascus.

The PRESIDENT (before the paper) : Mr. Douglas Carruthers, who has kindly undertaken to lecture to us to-night, has obviously many years' good work before him, though having already done some admirable scientific work. His first exploration of which I have any knowledge was that to Mount Ruwenzori, undertaken under the auspices of the British Museum. After that he went with Mr. Rickmer Rickmers to Turkestan, and we may hope to hear later on some of his experiences in those regions. Then he proceeded to Asia Minor, and he will to-night tell us something about his journeys in the lesser-known parts of Arabia. Subsequently he did some excellent work in the Dead sea region. He is, I understand, about to proceed on other journeys with some well-tried companions, and we may therefore look forward to a great deal more useful work coming from this explorer.

Mr. HOGARTH: If I must begin the discussion, I shall avail myself of the opportunity to congratulate Mr. Carruthers on having made an exceedingly interesting journey, and on having come safely back. I think you will all agree with me that he has spoken with rare sympathy and insight about that most interesting people, the nomadic people of Arabia. It is the people of romance *par excellence*, wandering for ever in the most God-forsaken country in the world. The Beduins on the west side of the delta have a story that the Creator actually forgot them in the creation. At the same time, as I think Mr. Carruthers has shown you, they are a very highly chivalrous people among whom it is not really difficult to travel if you observe their ways and keep the rules. Arabs appear to live by robbing one another, but that practice is carried on according to certain rules, which make it really very like playing a game—a great rough game like football, perhaps not even so rough as football after the American fashion. It is but rarely that many are killed at it, and I am glad to hear Mr. Carruthers bear his witness that the raider does not go out in the first instance to kill. There is one interesting feature of the game—that, in the case of battle near an encampment, it is a recognized thing that neither party enters the camp. The fight is carried on according to certain rules well away from the camp, and does not endanger the lives of the women and children, who are left behind to look after the camels.

Mr. Carruthers has been exceedingly modest about what he achieved, and it is of course true that he only got a very short way into Arabia; but he travelled over a road which has not been travelled before, so far as I know, and only one man (whom he mentioned), the Italian Guarmani, who was one time a consul in Jerusalem, has travelled over a tract of country near that which he took. Guarmani's account of his journey is extremely short and unsatisfactory, and, perhaps I might add, there has always been a certain doubt as to whether he took that journey at all. Mr. Doughty, at any rate, who has every reason to be heard with the deepest respect, has always refused to accept the fact of Guarmani's visit to Kheibar. I must congratulate the company on having been present to-night, when these photographs of one of the interior oases of Arabia have been put for the first time on the screen. They were very admirable photographs, and, indeed, I have not seen better of nomadic Beduins before. They seem to represent the life as really and as intimately as Mr. Carruthers' own account shows he had seen it. If he was not in any great danger in passing through the Beduin tribes, his dangers, as you see, began when he got into the first of the oases. That has always been the case in Arabia. It is perfectly true, as he said, that the oasis peoples are much more

fanatical, and, indeed, it is not difficult to understand. The Beduin knows perfectly well that nobody wants to take his land from him; but the oasis inhabitants are so rich, in comparison with the land about them, that they get an exaggerated idea of the value of what they possess, and they naturally expect that any traveller will be envious of them, and means to organize an expedition which will take their country from them. There is, of course, also the great fact of the slave-trade, which especially affects the oases dwellers. The latter are well enough acquainted with the outside world to know that the Western nations have set themselves against the trade on which they are dependent for their own well-being and life, and they naturally fear that any European will sooner or later subvert the basis of their existence. Teima is a very interesting place, which has retained its name from the most primitive antiquity which we know anything about, and has been made famous by the inscription now in the Louvre at Paris, which was found built into one of the lining walls of that great well of which Mr. Carruthers spoke. It has been visited, as Mr. Carruthers said, by more than one European, but Euting, who is now Professor at Strassburg, is perhaps the only other European who has been there. His companion, Huber, was murdered some time after he had been at Teima, but not, as perhaps Mr. Carruthers may have led you to suppose, as the result of his having visited that particular oasis, for he had got right down to the coast, and was about to start again into the interior of Arabia when he was murdered somewhere near the coast of the Red sea. I do not know that I need detain you more, except to express, in common with every one else who takes any interest in Arabia, the hope that this will not be the last journey Mr. Carruthers will attempt in that country. He must now be known to several of the most important people in the tribes of North-Western Arabia, and he will start on the second occasion with a very great advantage. Everything depends upon your being known and being passed on by one important person to another, and I hope that when things are a little quieter Mr. Carruthers will repeat his attempt.

Colonel MAUNSELL: I must congratulate Mr. Carruthers on a most interesting and instructive lecture. I cannot claim to have penetrated far into Arabia, still I have made a journey on the Mecca railway as far as Tebuk, and have been able to note some of the charms of the desert which he has described. The photographs naturally cannot convey all the brilliance of the desert scheme of colour, which is the great beauty of this part of what has been described as the "Garden of Allah." The general elevation is from 3000 to 4000 feet, and the air is extremely clear, dry, and bracing, so that long marches can be supported without fatigue.

The Batn-el-Ghrul station on the railway may be termed the "gate of Arabia Petræa," as it stands on the edge of a long depression which extends south for nearly 150 miles, the view being over a waste of hill and plain, reflecting the most brilliant colours, from the light yellow of the sand to the bright red and violet of the nearer hills and black and purple of the serrated ridges towards the Red sea coast. On the horizon possibly there will be a beautiful mirage clear-cut against the intense blue of the sky. I think we may deduce from this splendid desert air a considerable influence of climate upon the character of the Arab inhabitants; their thin wiry frame, nervous, high-strung disposition and imaginative temperament are direct consequences of living always in such air, and explains why the true Beduin pines away when removed to another climate and is shut up in a house.

As regards rivers in Arabia, there are of course none except broad dry wadis, which seldom contain water. The rainfall may be taken as triennial, and is usually very heavy for a short period. The water drains into large shallow depressions, one of which is near Tebuk, another near Jebel Itbaik on Mr. Carruthers' route, and a third the wide basin of the Wadi Sirhan. The underground river at Teima

is probably part of the considerable flow which moves underground in a mysterious manner towards the head of the Persian gulf, and is probably a tributary of the great Wadi Ermek, which joins the Shatt-el-Arab near Busra. The discovery of the ruined Khan on a route between Maan and Jauf is of great geographical interest, as it proves the existence of a communication on the shortest line between Egypt and Baghdad. Such a communication may well be restored by rail in the future.

I must again thank Mr. Carruthers for a most interesting lecture, and for a considerable addition to our knowledge of unknown Arabia.

Dr. STEIN: I have had the good fortune of spending some of the happiest time of my life in certain deserts, and I believe those who have shared such pleasures can understand why one cannot help feeling a deep interest in any other desert. Central Asia is a long way from Arabia, but I felt almost at home when some of those fine lantern-slides recalled to my mind scenes I had witnessed far away in the centre of Asia. When Mr. Carruthers spoke of the many weeks which he had spent travelling with the Arabs which afforded him protection, I confess I felt a sort of hearty envy. I believe that is the only way in which an extensive tract of country, offering such uniform features, can really be studied. I think, also, that the remarks which he made as regards the extent of vegetation, both along the sandy tracts of desert and among the dunes, will be appreciated by all those who have had problems of a similar kind to face in Central Asia. I have not been surprised at what he mentioned about the considerable amount of vegetation to be met with, even among the extensive tracts of dunes. We see the same, though on a smaller scale, in the Takla Makan; in fact, in most of the great sandy areas of Central Asia. I cannot go into the suggestions which might explain the occurrence of such vegetation; I believe it will be found that the formation of the ground is one of the chief factors which determine it. I was particularly struck by the great number of camels which these tribes are able to maintain in their wanderings. It is evident that Arabia receives great benefits from its vicinity to sea areas. It would be quite impossible anywhere in Central Asia to think even of hundreds of camels being taken about in this fashion by relatively large tribes; there would be neither water nor adequate grazing for them. I have not had the good fortune ever of travelling with a "fast train" of camels; it was my lot to pilot "goods trains" of camels through the desert, consequently I cannot claim such experience, as Mr. Carruthers no doubt gained, of the finer type of camel, but I can entirely support what his personal experience has shown as regards the length of time camels can work altogether without water. If in Arabia camels can be used for riding, without getting wasted, for seven or eight days without water, it is not much to be wondered at that those "goods trains" of camels in Chinese Turkestan can march along for more than two or three weeks, carrying heavy loads, without replenishing their water-supply. I have had myself the pleasant experience of taking such a "goods train" of camels for sixteen days through heavy dunes, and I am entirely convinced that the statements which are heard from men who have managed camel caravans, that their animals have maintained themselves for over three and four weeks during the winter, are correct. It is very largely, I believe, a question of the heat to which the animals are exposed. I can only conclude these remarks by an expression of my great pleasure in hearing of the interesting archæological discovery which Mr. Carruthers made towards the end of his journey. It was indeed a lucky raid which enabled him to find the old caravanserai along what evidently looks like a route from Egypt towards the Persian gulf. With regard to the remark that he made that this would be likely to indicate a better physical condition of the region, I must venture to make a historical observation. Where

human factors are concerned, we cannot entirely go without direct historical evidence. I have too often noticed that just at periods when apparently prosperity was low, yet such periods were marked by special measures for the protection of thoroughfares to facilitate progress. It is just at times when traffic is difficult that human ingenuity makes great efforts to overcome the difficulties of nature. I wish to express again my hearty admiration for the power of endurance which evidently enabled Mr. Carruthers to perform this long arduous journey.

Captain SLACK: The lecturer has referred to the Austrian dollar, the Maria Teresa. I should like to know something as to its value, which is, I think, about 3*s.* 6*d.*, but I should be glad to know whether that is so, and also where Mr. Carruthers changed his money to carry out his expedition. I believe the Maria Teresa dollar is used down the Red sea, and also as far as Zanzibar. He might also tell us whether there is any idea of carrying the railway down south. I think he also said that there were not so many secrets now to be extracted from Arabia, but I hope he will do us the pleasure of affording some of his experiences in further expeditions he may take in that direction. I think there are a very great many secrets to be extracted from Arabia, and very little is known of its southern interior.

The PRESIDENT: I also want to ask the lecturer one question before proposing the vote of thanks to him. I notice that he speaks of the sand-dunes beginning quite suddenly—that you could almost step from the desert land on to the sand-dunes. The other day we had a very interesting paper from Mr. Beadnell on the sand-dunes of the Libyan desert, who mentioned the same thing, and described how sand remains drawn together in as it were long strips stretching for miles across the country. Has Mr. Carruthers ever considered what makes the sand remain in distinct patches, or why in some valleys it looks almost like water, its edges are so well defined? I venture to suggest the following explanation as possible. The sand, either because it contains air in its interstices, or possibly because of its physical conditions, may hold the heat better than the surrounding desert. Now, if this be so, during the night there will be an up-rush of air from the sand-dunes and an in-rush from the desert, and the result will be that any loose particles of sand on the desert will be as it were swept on to the sand-dunes, and a tidy edge will thus be given to this formation. I hope Mr. Carruthers, when he again visits such regions, will take the trouble to measure the temperature during the night-time of the sand-dunes, and of the desert near it, in order to see if this theory is likely to be correct. In conclusion, in your name I have to thank Mr. Carruthers for the very interesting and valuable description of this wild region.

Mr. CARRUTHERS: As to the rate of exchange of the Maria Teresa dollar, I cannot remember off-hand exactly what it was, but they are to be procured in Damascus only through the Arabian merchants. You cannot buy them up in the deserts, nor exchange them at the ordinary moneychangers. I obtained mine privately. The dollar, by the way, is used all over Arabia, not only on the Red sea-ports, it is current all over Central Arabia. The natives won't take Turkish money of any kind except the gold lira. As to the railway extension, I do not think it will be carried much further than Medina for some time. The tribes between Medina and Mecca will not allow it at all. I think Major Darwin's explanation of the distribution of the sand very sound indeed, and I hope the next time I go I shall be able, perhaps, to find out a better explanation.

NOTES ON KORDOFAN PROVINCE.*

By Captain WATKISS LLOYD, The Cameronians (Scottish Rifles).
Late Governor of Kordofan.

In 1899, when the Khalifa was killed at Um Debreikat, our knowledge of the country between the Nile and Darfur was extremely limited. The best available maps were War Office map I.D. 332 and the French staff map of Africa, the latter being the more complete, as the routes of all known travellers were shown. Though many of these routes were very inaccurate, they were extremely useful. The western, south-western, and most of the southern portions of the province were shown as blank and quite unexplored. Several travellers had described the eastern and northern districts fully and accurately, but the ravages of the Dervishes had destroyed all the villages, and where former travellers described miles of waving fields of corn we found nothing but bush. One of the most accurate observers was Ignatius Pallme,† much of whose work might have been written yesterday. His description of a raid by the troops in 1838 goes far to explain the difficulties we have often had with the Nubas.

In December, 1899, Colonel B. Mahon, C.B., was appointed Governor, and reoccupied the province, and from that time the work of exploring and mapping the country has gone on until there are now no considerable blanks left on the map. The route-sketches were generally made with a prismatic compass, the distances being timed, but some triangulation has been commenced, and a number of observations for latitude have been taken all over the province. In 1902 I compiled the work that had been done on a scale of 1 : 500,000, and it was printed for local use (I.D.W.O. 1629 and 1630). The result was, of course, too inaccurate to publish, but it gave a general idea of the country. Soon afterwards a few sheets were published on a scale of 1 : 250,000. Captain H. D. Pearson, R.E., Director of Surveys, has now compiled the greater portion of the province map on a scale of 1: 250,000, and a map on a scale of 1 : 1,000,000 is in course of publication. This, though not accurate from a strictly cartographical point of view, gives a good idea of the country, and will be of the greatest value for military and administrative purposes. Nearly every one is convinced of the necessity of such a map being based on a triangulation, but in a poor country, where the Survey staff is limited, it is only possible to make use of the best means available, and with care and practice it is extraordinary what good results can be obtained with time-sketches

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* Map, p. 356.

† There is a German copy in the Society's Library, and an English translation in the London Library.

checked by a few observations for latitude. Keeping the maps and route-reports up to date involves much work, as not only are new villages constantly being built, but old ones are often moved several miles to fresh ground, and in some parts of the country the system of naming villages after the sheikh leads to changes of name whenever a sheikh dies.

As at present constituted, the province of Kordofan consists of some 130,000 square miles, and has a population estimated roughly at half a million. The name, which dates from the time of Mohammed Ali Pasha, is really a misnomer, as the Arabs only know the country round El Obeid and Jebel Kordofan as Kordofan, each portion of the province being named according to the tribe that inhabits it, as Dar Homr, Dar Nuba, etc., that is, the country of the Homrs, or the country of the Nubas. The whole province is about 400 miles from north to south and 350 miles from east to west, and falls naturally into two divisions, the dividing line running obliquely from lat. 12° N. on the Darfur frontier to lat. 13° N. on the White Nile.

We will consider the northern portion first. It consists of a plain broken in the north by clusters of granite hills which rarely exceed 600 feet above the plain. The plains are generally sandy, and have been formed by the destruction of granite and sandstone hills by the action of heat and wind, but north of lat. 14° 30′ N. they are often stony and broken by many wadis (watercourses or valleys) which run down from the hills, and either lose themselves in the sand or, striking a rocky ridge, form a small lake, which quickly dries up after the rains cease. The salt left behind is often worked by the natives. These plains are either bare or covered with low bush, which becomes thicker and more dense in the wadis.

About lat. 14° 30′ N. the real bush commences, and the country becomes more undulating. There is no visible watershed, and the rain sinks in where it falls, though in a few places it collects in ponds (called fulas) which hold water for a few weeks after the rains cease. This district extends as far south as the line between northern and southern Kordofan, and in it are found most of the gum forests which constitute the chief wealth of the province.

Along the river there is a belt of low ground, chiefly black soil, which is in places 12 miles wide, but often much less. This ground, which is very fertile, is broken by many watercourses, and much of it is liable to floods at high Nile. Politically it belongs to the White Nile province. Westwards of this low-lying belt the country rises rapidly, the soil becoming much more sandy when the river-valley is left and El Akaba, a waterless and almost treeless district reached. This extends from Id el Ud and Zereiga on the east to Hashaba and Jebel Kon on the west, and is uninhabited except during the rains, when the riverain population drive their flocks into it, as the grass

which then springs up affords excellent pasture. In the dry season it is a shadeless and barren waste.

West of El Akaba the country is undulating, the hills becoming higher and steeper towards the west, until within 10 miles of El Obeid, an almost level plain is entered. Towards the valley of the Khor Abu Habl the undulations develop into well-defined ridges having their general direction north and south. West and north-west of Bara the sandhills become very steep and soft, and enclose a number of small

BAOBAB TREE USED FOR STORAGE OF WATER. THE MAN ON THE BRANCH IS GETTING WATER OUT OF THE TREE.

basins. At the bottom of each basin, locally called a "khor," the soil is white sandy earth containing some lime. Water is found at a depth of from 4 to 10 feet. As the soil is fertile and water-wheels can be used, this district, which is known as El Kheiran (*i.e.* the Khors), was formerly very highly cultivated. It extends from Ashaf in the south to Shershar in the north, and was devastated by the Dervishes when retreating westwards after the battle of Omdurman, but is now recovering rapidly.

The plain round El Obeid is comparatively level, and the soil much less sandy than in most parts of northern Kordofan. Except in El Obeid, where there are many excellent wells, water is scarce. The soil is, however, fertile, and there are many villages. Thirty miles west of El Obeid, Dar Hamar commences and extends to the Darfur frontier, a distance of about 170 miles. It consists of sandy steppes covered with bush where it has not been cleared for cultivation. The country is quite devoid of watercourses except in the vicinity of the northern hills, but there are several large valleys, which are generally full of baobab trees (*Adansonia digitata*) and are locally called "shegs," viz. Sheg el Dud * and Sheg el Hafiza. The hills in the north are nearly all granite, though there are a few of sandstone, such as Jebel Beraish near Foga and Jebel Wad Heidub near Nahud.

Water is the most absorbing topic of conversation in Northern Kordofan. North of lat. 14° N. the numerous watercourses contain much surface water during the rains, and in good years for two months afterwards. When the surface water dries up, wells are dug and deepened from time to time until the water gives out. There are, however, several places like Safia, and Bagaria in the Wadi el Malik, where a good supply of water can always be obtained. It is quite a mistake to regard the country west of Khartum as a waterless district. Now that the people have returned and opened the wells, it is, even in the dry season, very exceptional to go 100 miles without finding water, though there is not enough to support a large sedentary population.

In the country between El Akaba and the river there is plenty of water all the year round. Between El Akaba and El Obeid the wells are numerous, and water is found nearly everywhere but in ever-varying quantities, the wells being supplied from a small area and dependent on the local rainfall. The best are generally in the sandy hills, which hold the water better than the low-lying and more clayey country. The best wells are in El Kheiran, where water is found a few feet below the surface, elsewhere wells are often 100 feet and sometimes nearly 200 feet deep. They are of two kinds. The first, as at El Obeid and in parts of Dar Hamid, are cut through firm soil and not lined. These last for years and require little care. The second kind, which are far more numerous, are dug through the sand. They are seldom more than 4 feet in diameter, and as the sand is dug out, have to be lined with grass rope, which is put in in lengths of 30 or 40 feet until the water-level is reached, when the roots of trees are used as standing the water better. These wells seldom last more than two or three years, when they fall in. As it is easier to dig a new well than to repair an old one, the fact that the remains of many old wells are

* Marked on old maps as Cheguedou.

found at a village does not indicate that more than one or two were ever open at one time. West of El Obeid in Dar Hamar there are practically no wells except at El Odaiya and Nahud, the water at Foga, which was formerly the great Hamar watering-place and the site of a Mudiria, having completely given out.* Elsewhere the people are dependant on water-melons and the water they store in baobab trees. The melons are small and almost tasteless, and are grown in enormous quantities amongst the corn. When ripe they are collected in heaps and protected from the sun until required for use.

The baobab trees have to be carefully prepared for use as reservoirs. The large branches are first cut off near the trunk. If this is not done, the trunk is apt to split as soon as it is hollowed out. A hole is cut in the trunk, generally just above a branch, which serves as a platform

THE BAHR EL HOMR AT FAGOI, CAMEL CORPS WATERING.

for the man who is filling the tree, and the interior is hollowed out. Round the bottom of the tree a shallow basin some 20 or 30 feet in diameter is made, in which the rain-water collects. As soon as there is a storm, the people go out and fill their trees. The water so stored remains perfectly good until the end of the next hot weather, or even longer. A few trees, naturally hollow, have a hole at the top between the branches, and fill themselves, the branches catching the water and acting as gutters. These are called "lagai," and are highly valued by the Hamars.

* The cause of the water giving out has not yet been satisfactorily explained. The same thing has occurred at other places, such as Melbis, which was formerly the garden of El Obeid. At Abu Haraz water-wheels were formerly used, but the water, though sufficient, is now much too far down to make their use possible. On the other hand, at El Obeid and some other places, water is now found nearer the surface than it was twenty years ago.

The Arabs did not invent this method of storing water, but improved on the system of their predecessors, who made the hole in the trunk only 10 or 12 feet from the ground. The present system gives a cistern 20 feet high and from 8 to 10 feet, or even more, in diameter. Owing to the labour involved in preparing and filling the trees, water is usually bought and sold, and on the main roads where there is much traffic, as between Nahud and Jebel el Hilla on the way to El Fasher, the capital of Darfur, the people do a regular trade by supplying merchants and travellers with water.

The bucket, called a "dilwa," used by the Arabs deserves mention. It consists of a piece of leather suspended by strings 6 inches long from a piece of wood bent in a circle, to which the rope used for drawing the water is fastened by three or four strings. On reaching the bottom of the well the leather opens out and collects the water, however little there may be.

Along the southern edge of the Gawama country, where the sand-hills end and the black soil of Southern Kordofan commences, there are three small lakes, El Birka, Rahad, and Sherkeila. El Birka is generally dry by December, but the two last hold water till the end of January, and sometimes for the whole year. When they are dry, wells are dug in the beds of the lakes and give a good supply of water. It is doubtful if any of these lakes connect with the Khor Abu Habl at any time, but it is possible they do when they get exceptionally full and overflow.

To turn to Southern Kordofan, which is the home of the Baggara or cattle-owning Arabs and the Nubas. Here we find a totally different country, consisting of a plain of black soil, from the middle of which the rugged granite hills of Dar Nuba rise to a height of 3000 feet. Instead of the rain sinking in where it falls, as in the north, the country is drained by several considerable watercourses, which carry much water during the rains, though all are dry a few weeks after the last storms.

The country between the White Nile and Dar Nuba is covered with thick bush and cut up by khors or watercourses, many of which flow northwards to the Khor Abu Habl. Along the river there is much swampy ground, and numerous channels parallel with the river make landing a matter of some difficulty at all seasons, and quite impossible at high Nile except at the recognized "meshras," or landing-places. The soil, which becomes wet and heavy during the rains, is full of shrinkage-cracks in the dry season, so that travelling is always troublesome work.

Dar Nuba occupies an area about 150 miles square. The hills rise abruptly from the plain with but little system, sometimes in large masses like Tagali and Miri, but often as isolated hills, but the general trend of the main valleys is north and south. The hills differ much

in their formation. Some, like Nyema and Fanda, consist of masses of huge granite boulders containing many caves and hiding-places which are used by the Nubas in time of war. On many of these hills there are passages behind the rocks which enable the inhabitants to move about without exposing themselves. These passages are partly natural, but have been improved by the natives. The interior of such hills is full of narrow valleys, which can only be reached by steep and difficult paths. The inhabitants often successfully resisted the Dervish raiding parties, and when we first reoccupied the country they believed their hills to be impregnable, and were apt to give trouble by raiding their weaker neighbours. Other hills, such as Ghulfan, are less rocky, and

OLD GOVERNMENT BUILDINGS AT EL OBEID, 1900.

have earth up to the top. These were sometimes completely depopulated by the Dervishes, and even now a few remain uninhabited.

West of Dar Nuba the plain extends to beyond the Darfur frontier. Except where cleared for cultivation, it is covered with bush, which gradually changes into forest towards the south, as the valley of the Bahr el Homr is reached. South of Dar Nuba the plain consists of black soil overlying the sponge-like ironstone characteristic of much of the basin of the Bahr el Ghazal. The bush extends to within 20 miles of the river, beyond which is a treeless tract of black soil which in the rains becomes a swamp, and is covered with high grass, while in the dry season it is full of shrinkage-cracks and the grass gets

burnt. This sort of country, which is also found in parts of Dar Homr, is called "fau" by the Arabs, and travelling across it is exceedingly laborious at all times of year.

The drainage system of Southern Kordofan is simple. The Khor Abu Habl rises in the hills west of Dilling, and flows north-east to Sungikai, where it turns east, finally losing itself in the sand-hills near Gedid. During its eastern course it is joined by many affluents from the south, most of which rise in the Nuba hills. There are many good wells along its course.

Commencing as a "sheg" in Dar Hamar, the Wadi el Ghalla flows south-west past Abu Zabbad and Muglad, and enters Darfur about lat. 10° N., and according to native accounts, which I have every reason to believe, loses itself in the plains a few miles beyond the frontier. On reaching the black soil near Abu Zabbad, the valley widens and the bed is full of grass and large "sunt" trees (a kind of acacia). At times it holds much water, though there is never any stream. Along the high ground on both banks there are hundreds of Arab camps and villages, with much cultivation (hence the name, Ghalla, meaning bread). As soon as the surface water dries up wells are opened in the bed of the wadi, which provide water for thousands of cattle until the following rains. To prevent these wells washing in, the mouths are often built up to a height of 8 or 10 feet above the ground. Its valley is far the best-watered district in the province outside Dar Nuba. The third important watercourse is the Wadi el Azrak, or Khor Shalango, which flows southwards along the western edge of Dar Nuba, being fed by many streams rising in the hills. It flows in a narrow but deep channel through a level valley, and often carries much water, overflowing its banks in many places for a considerable distance, though it runs dry very soon after the last rains, and in the dry season the watering-places in its bed are very few compared with the Wadi el Ghalla. It finally loses itself in the swamps near Turda.

Many of the khors from the southern hills run into Lake Keilak or Lake Abiad, neither of which has any known outlet. The former always contains water, and is about 6 miles long by 2 broad after the rains. It contains two kinds of fish, which are caught in large numbers by the natives. El Abiad is a much smaller lake, and only fills occasionally.

In addition to the wells in the khors, nearly all the Nuba hills contain good springs, and on many running water is found until the beginning of the hot weather. The worst-watered part of the country in the hot weather is Dar Homr, north of the Bahr el Homr, and the uninhabited country south of Jebel Eliri.

In the south, about lat. 10° N., is the Bahr el Homr, a river which, according to Sheikh Ali Gulla, the Nazir of the Homrs Ageira, rises

some 30 miles beyond the frontier. Following its course from the frontier to Hassoba, I found its actual bed was usually 100 yards wide, with steep, well-defined banks 10 or 15 feet high, but it contains much grass, and its lower reaches are completely blocked. It eventually joins the Bahr el Ghazal, but its actual point of junction is disputed. When it runs dry, about the end of January, the Homrs come south from Muglad and dig wells in the bed, which provide them with water until the next rains. Thirty miles further south, flowing nearly parallel with the Bahr el Homr, is the Bahr el Arab, the large river which rises beyond Hofrat el Nahas and flows eastward to the Bahr el Ghazal. It contains much open water, but its lower reaches are at present blocked with sudd. Lieut. Huntly-Walsh, R.N., who has explored much of its

STREET IN EL OBEID, 1908.

course, believes it would be possible to clear it. A very small portion of this river is in Kordofan, nor does it drain any considerable area of the province.

In such a large district the variations of climate are necessarily considerable. In the south the rains commence earlier, often about the middle of March, and end later than in the north. About the latitude of El Obeid the climate is good from November to March inclusive. Then the heat becomes oppressive, until the wind turns to the south about the end of April and brings the first rains. The wet season continues until about the middle of October, when the wind goes round to the north. Observations are taken at El Obeid, and show that the rainfall seldom exceeds 25 inches, July being the wettest month. In the south the rains are much heavier and last longer, and in the west, owing to the absence of hills in Dar Homr, the rains generally reach further north than in the eastern districts.

The province cannot be regarded as a health resort, though the accounts of most former travellers were much exaggerated. Malaria is the chief cause of sickness, and is prevalent all over the province, being worst just after the rains. Mosquito brigades have, however, done much to improve matters at the Government posts during the last few years. The Arabs very quickly grasped the fact that mosquitoes carried malaria, but the blacks and low-class Europeans were often troublesome to deal with. Among the natives consumption is rare, and cholera, scarlet fever, and enteric seem unknown. Leprosy is very common among the Eliri blacks, and elephantiasis is found in most parts of Dar Nuba. It is now some years since there was an outbreak of small-pox, but the Arabs are afraid of it and always value vaccination. Guinea worm occurs all over the province, but is most common in the southern districts.

Kordofan never formed an independent sultanate like Wadai, Darfur, or Senaar, but seems to have been in the hands of the last in very early times. In 1784 it was conquered by the Furs, who held it until 1820, when Ahmed el Defterdar defeated the Fur governor near Bara and conquered the country for Mohammed Ali Pasha. There seems no doubt that the original inhabitants were Nubas, or people of a kindred race, who were driven from the plains into the Nuba hills, and almost exterminated in the northern hills by the successive incursions of Fungs, Furs, and Arabs. The few people of non-Arab descent left in the northern hills are much mixed with Arab blood, and have quite lost their own language. These hills are covered with ruined villages, which the Kababish say they destroyed in recent times.

The present population consists of Arabs and Nubas, the latter being confined to the hills in southern Kordofan. The Arabs are divided into camel-owners, sedentary tribes, and Baggara or cattle-owners. The chief camel-owning tribes are the Kababish and Kawahla, but the Shenabla and Beni Garar own considerable herds. During the rains they drive their herds to beyond the Wadi Melh, the great wadi which, rising near Foga, extends northwards to the Nile near Korti. As the grass and water dry up they move south and east, until the Kababish are round Safia and Kagmar, the Kawahla in Dar Hamid and near Shegig, and the other smaller tribes among the Gawama villages and east of El Akaba. In addition to their camels, they own large herds of sheep and goats and a few horses. The great majority live in tents made of wool, and have no cultivation, living on their camels' milk and grain which they buy from settled tribes; but some of the sub-tribes have a little cultivation, and keep their sheep and goats near their permanent villages, which are all near Dueim. A nomad, however, always looks down on a cultivator, and some of the smaller tribes like the Maalia and Maagala, who lost all their herds during the Khalifa's rule, look forward to the time when they will be able to become nomads again.

The sedentary tribes occupy the country between lat. 14° N. and lat. 12° N. Between the river and El Akaba the most important are the Husseinat and the Hassania. West of El Akaba is the Gawama tribe, who own all the best gum-forests and are the richest of these tribes. To the north of their country is Dar Hamid, occupied by many small tribes of mixed origin, including the Ferahna, who are said to be descended from ancient Egyptian merchants. The Baghada, a small tribe living near Homra, claim to have come originally from Baghdad. Round El Obeid the Bederia and Shweihat are the chief tribes. They own considerable flocks and herds and much cultivation. Westwards from El Obeid, and extending to the Darfur frontier, is the

NUBA TYPES.

country of the Hamars, the largest tribe in the province. They have always been divided into two sections, the Asakara and the Degagin, under separate nazirs. Since the reoccupation of the country a portion of the latter section, the Ghereisia, have formed a new section under a nazir of their own. They formerly owned thousands of camels, but their herds were nearly all destroyed during the Dervish rule. Purdy says he saw some 30,000 camels watering at Foga in 1875. Owing to the absence of wells in their country, they have very few sheep or goats and practically no cattle. They have much cultivation, and usually have a large surplus of corn, which they make into merissa, or native beer. This is consumed in large quantities, and

drunkenness is exceedingly common among them. They also own large gum-forests, but at present the cost of transport prevents these being worked profitably. It may be possible to use them when the railway reaches El Obeid.

These tribes all live in villages, which vary much in size, but as a rule seldom contain more than sixty families. In Dar Hamar the size of the villages depends on the number of baobab trees available within a convenient distance. The huts are of the usual African conical shape, and the form built by the different tribes differ very little. As a rule, the workmanship is inferior to that seen among the Nubas.

The only large towns are El Obeid and Nahud. El Obeid, the capital of the province, has a fluctuating population, which reaches a maximum of about 12,000 in the dry season, when there is no water in the surrounding villages. The native town consists chiefly of straw huts, though the markets and many of the merchants' houses and shops are built of sun-dried brick. The chief trade is in grain, cattle, cottons, and gum. The barracks and Government buildings are at the south end of the town, and separated from the native quarter by a parade ground 500 yards wide. The town is built on the sides of a shallow valley, in the middle of which there are numerous excellent wells. Nahud (in Dar Hamar) contains some 10,000 inhabitants. It is the terminus of the telegraph line, and has a large market, the chief trade being with Darfur, where cottons and trade goods are sent in return for cattle and ivory. The town is built round a hollow, which contains the wells. In 1900 it was the only town in the province, El Obeid having been utterly destroyed. It then contained some 5000 inhabitants. Both towns have now been laid out with straight wide streets, and have an elementary local administration.

Practically all the Arabs in southern Kordofan belong to Baggara, or cattle-owning tribes. The Selim and Walad Hameid occupy the country between the Nile and Dar Nuba, and the Habbania live near Sherkeila. These tribes are small, and not very well off. The Howazama, a large and fairly rich tribe, occupy the greater part of Dar Nuba in the dry season. During the rains their chief camps are on the pools (*fulas*) between Sungikai and El Obeid. They are a large tribe, and are now very well off, having not only large herds of cattle, but many sheep, goats, and horses, and a considerable area under cultivation, though they do not grow enough grain to supply their wants, and have to purchase the remainder from the Nubas. The Messeria, a small but rich tribe, occupy a number of villages on the upper part of the Wadi el Ghalla during the rains, and in addition to large flocks and herds, have much cultivation, and bring large quantities of grain for sale into the markets at El Obeid and Nahud. During the dry season they go to various watering-places in the western Nuba hills, ranging as far south as Jebel Dago and Jebel Abu Likri. The country between Dar

Nuba and the Darfur frontier belongs to the Homrs, whose country I described in the *Journal* on a former occasion.*

The Baggara have a bad name on account of their cruelties under the Khalifa, and they would no doubt raid on every possible opportunity if they dared. At the same time, they are the most enterprising people in the province, and many of the poorer men go down to the river and work on the public works in Khartum until they can save enough

NUBAS. THE MAN ON THE RIGHT IS THE KUGUR DALDUN OF J. FANDA.

money to buy some cattle and settle down in their own country. Petty crime is practically unknown among them, and their internal quarrels are nearly always due to the efforts of some sub-tribe to increase its wealth or position in the country. Like all nomads, they are extremely independent, and tribal organization is only kept up by the distrust the tribes feel for one another, though a sheikh, once he has been accepted by the tribe, is usually obeyed loyally as long as he is a just man and settles tribal matters fairly. It is always impossible for a European

* See *Geographical Journal* for June, 1907.

to fathom the mind of an Oriental, but a Baggara Arab can generally be trusted to speak clearly and fully if he thinks he has a grievance, provided he knows the official he has to deal with.

The Nubas, who now all live on the hills, know little of their early history, and their legends are few and hazy. They say they formerly occupied the country as far north as Halfa, and when one remembers the countless thousands of slaves who must have been taken out of the country since early Egyptian times, this seems quite possible. They were undoubtedly driven south by the Arab invasion of the Nile valley, and no doubt suffered from the various Fung invasions, being finally driven out of the plains when the Baggara tribes came from the west. The way in which Nubas speaking different languages * are mixed up, adjacent hills being often unable to understand one another, points to the remnants of the tribes from the north and west having fled to the hills and settled on any unoccupied ones they could find. Some may not have been hill tribes originally. The people of Jebel Dago, Shat el Safia, and Shat el Damman speak the same language. The natives of the two last hills say they formerly occupied the whole of Dar Homr, and this is confirmed by the Homr Arabs, who say there is still a small settlement of the same tribe at a place they call Shat, a few miles over our border. Whether they are related to the large Dago tribe in Darfur, mentioned by Slatin Pasha, I cannot say.

In southern Kordofan the Nubas seem to have been left alone until the arrival of the Baggara Arabs, who divided the country among themselves and raided the Nubas for cattle and slaves. When Mohammed Ali Pasha took over the country, no attempt was made to administer the southern districts; but tribute was taken, often in the form of slaves, from the Arabs and more accessible hills. To collect the tribute troops were sometimes necessary, and Pallme gives an interesting account of such an expedition against Jebel Daier. Under the Dervish rule, the Emirs sent to attack the Nubas reduced the more exposed hills, and in some cases carried off almost the whole population, but many of the larger hills, such as Nyima, resisted their attacks to the end, though they lost very heavily. As a result of their treatment in the past when we reoccupied the country, though the Nubas were very pleased to welcome the troops who had defeated the Khalifa, they were not prepared to trust us very far. They are, however, gradually settling down, though still not above raiding one another from time to time.

Many of the hills, such as Tagali and Tagoi, are Moslem, but the majority have a religion of their own, which among the northern hills is well defined, becoming more indefinite towards the south, until at Talodi no trace of religious ideas can be found. All the Moslem and

* Eleven languages are known to exist, viz. Dilling, Katla, Koalib, Keiga, Moro, Tagali, Dago, Misakin, Kadugli, Krongo, and Nyema.

most of the other hills are ruled by a mek, or hereditary headman, who is controlled by a council of elders. In the rest, the kugur, or head priest, whose power is almost absolute, rules the people, though in a few hills there is both a mek and a kugur, the latter being generally the more powerful.

The Nubas are not idolaters, but believe in one Supreme God who rules the world through spirits (called Arro) appointed from the dead ancestors of each hill. In the next world each hill has its own appointed place, to which the inhabitants go at their death. The kugurs act as mediators between the Arro and the people, and are credited with power to bring every sort of misfortune on the people if they like. Their influence is, therefore, enormous. As they receive a share of all

NUBA VILLAGE.

crops, cattle, and of all loot taken in war, they are generally well off and always difficult to deal with. When a kugur dies, the people wait until one of their number declares the "Arro" has entered into him. He then makes a prophecy of some sort, and if it comes true he is proclaimed kugur. By this means of selection the kugur is generally the most astute man in the district. Occasionally a woman is chosen, there is one at Farla. Being opposed to any stronger outside influence, the kugurs are generally against Government interference, but their mutual jealousies make any combination among them unlikely.

Nuba fights and quarrels generally begin with some young man who wants to get married raiding for cattle. One or more people get killed, and a vendetta is started which goes on in a casual way for

years. The attack on a village is never pressed home, and usually leads to but little loss of life. Against the Arab slave-raiders the Nuba was always on the defensive, and fought with desperate courage. The northern hills are well provided with Remington rifles, which they either took from the Dervishes or purchased from the Arabs, who formerly relied more on their horses and spears than on firearms, and were glad to exchange rifles for cattle. Now they would give anything to get the rifles back. Ammunition is manufactured locally. The old cases are filled with powder made locally, the caps being made with matches covered with lead-paper. The men who have no rifles are armed with clubs, spears, and shields, and all carry a long knife. The clubs are of the knobkerry type, sometimes furnished with stone heads. Shields vary much in shape, and are made of leather. Most of the spears have iron heads, either made locally or bought from the Arabs, but in some of the more remote hills spear-heads of hard wood or bone are still used.

In character the Nuba is brave, very conceited, and intensely suspicious. According to his own lights, he is industrious, as he clears large areas for cultivation. When not cultivating, that is for seven or eight months in the year, he sits on his hill and looks at the view, or does a little raiding. He has, however, considerable manual dexterity. He builds excellent huts, and shows much skill in making his household utensils, though the true Nuba makes no kind of cloth. On most hills both sexes go almost naked, and on a few, such as Fanda, they are absolutely so. The women ornament themselves with scars cut in elaborate patterns, and on some hills stain themselves with reddish earth. Those that are better off wear brass or iron bracelets and earrings, and the women often have elaborate girdles of beads, and a strip of cloth worn between the legs and hanging down to the ground in front and behind. Near Government stations Manchester cottons are coming into use—a doubtful advantage, as the Nuba never washes, and his villages are indescribably filthy. Many villages now own considerable herds of cattle, and all have numerous sheep and goats of a small and active breed, they also keep a small breed of pig, the flesh of which is much valued; the less said about its habits the better.

Physically the tribes differ a good deal, the northern tribes being generally smaller and of lighter build than the southern ones. In colour the majority are a reddish-black, that is, lighter than the Dinkas and darker than the Niam-Niam.

Round the base of some of the southern hills, such as Eliri and Talodi, there are settlements of escaped slaves, who revolted and ran away from the Howazama and Homrs many years ago. They are a low type of black, extremely dirty and lazy, and suffer much from leprosy. They speak Arabic, and call themselves Arabs, though really

a mixture of many black tribes. Each sub-tribe retains the name of the Arab tribe it formerly belonged to.

The resources of the province are considerable, but require time and population to develop them. All the main roads have been cleared of bush, and a railway is to be built from the river near Kosti to El Obeid, but at present all transport is by camels in the north and pack-bulls or donkeys in the south. The chief source of revenue is gum arabic. Only the forests near El Obeid and between El Obeid and the river are worked; but with the arrival of the railway, it will no doubt pay to work the forests in Dar Hamar, which are of vast extent. The best gum comes from the grey acacia, called hashab.

IRON-SMELTING FURNACE AT NAHUD.

This is found chiefly between lats. 13° and 14°. The method of cultivation is simple. In December or January strips of bark half an inch wide are torn off the tree, and any dead branches cut away. As the hot weather comes on the sap runs up the tree and oozes from the wound. The gum is collected about every ten days, until the rains commence. Gum is also collected from uncultivated trees, but is worth little. South of the Khor Abu Habl there are large forests of red gum trees (talh), but they are of comparatively little value and seldom worked.

The chief grains grown are dukhn (*Pencilaria spicata*) in the north and dura in the south. The latter requires more rain and better soil than dukhn. Both are ground and baked into flat unleavened

cakes, or made into beer. Simsim is grown all over the province, but especially near Sherkeila. The seeds are crushed, and the oil so obtained is used for cooking and hair-dressing.

In the Nuba hills, tobacco is grown in considerable quantities for home consumption and sale to the Dinkas. The leaves are cured with wood ashes, and have a pungent and unpleasant flavour. It is smoked in pipes with large earthenware bowls, or made into snuff. Cotton is grown in small quantities, and woven into a coarse cloth called "damur" on hand-looms. It is of no value for export, being very short in the staple. Egyptian cotton has been tried, but it deteriorates rapidly.

Of domestic animals, camels are the most important in the north. They are large, heavy animals of a reddish colour, and can carry from 400 to 600 lbs., but are of little value for riding. When working they are watered every fourth day, but, if only grazing, often go twenty days without water. They should never be taken south of El Obeid, as, in addition to the danger from poisonous plants that thrive on the black soil, they are apt to contract Trypanosomiasis. It is believed that the parasite which causes this disease is carried by the serut fly (*Pangonia magretti*).

In southern Kordofan cattle are all-important, and the Arabs own enormous herds. They are small active animals of the humped variety. The bulls are used for pack purposes, and are extremely docile. The saddle is made of two pads of straw, on which a load of 200 to 250 lbs. is placed. No girth is used, but each animal is ridden by a woman or child, who balances the load. When the ground is boggy there is no animal to equal them, as they will push on at 2 miles an hour where a horse would founder, but, as they are never shod, they soon get footsore on hard ground. They are only watered once a day, and can go anywhere in the south, except near the Kowalib hills, where the tsetse fly is prevalent.

To own a horse is the great ambition of every Arab. The Baggara have considerable numbers, but their quality is indifferent, and they show signs of inbreeding. They are seldom more than 14.2, but have fair bone and will stand a lot of work on poor food. Like the cattle, they are only watered once a day. The Messeria own the best, but, like all the tribes, ride their horses too young and ruin their legs.

The mineral resources are rather limited. Gold was at one time washed near Tira Mandi, but it no longer pays to work it. Iron is plentiful, and is smelted at Um Simeima and Nahud in the north, and between Kurondi and Duleiba south of Jebel Eliri, in Dar Nuba. At Nahud the work is done by people from Bornu. The ironstone is heated with charcoal in cylindrical mud furnaces about 5 feet high and 2 feet in diameter, a draught being kept up by means of bellows. Smelting takes about twelve hours, at the end of which the furnace is broken, and the iron is found in a lump at the bottom.

Salt is found in considerable quantities, chiefly in the north, but there are also deposits in Dar Nuba. It is either found in salt-impregnated earth, which has to be washed to dissolve out the salt, or in salt wells. In both cases the salt is obtained by boiling away the water and collecting the residue.

The forests, with the exception of those containing gum trees, are of little value, and the want of good timber is severely felt, even in the south where there are many large trees. Most of the trees are either small and crooked, or, when large, either very hard like the sunt, a kind of acacia, or too soft like the baobab.

There is a good deal of game in the country. In the north the wild sheep is found among the hills, and the oryx (*O. leucorynx*), western tiang (*Damaliscus korrigum*), and ril (*G. addra*), in the plains. The last is also found in El Akaba. In the central portion of the province there are only *Dorcas* and *Rufirons* gazelle. Near Jebel Kordofan kudu are now scarce, but they are more common further south. On the Bahr el Homr, roan antelope, Jackson hartebeeste, and tiang are common, and Dar Homr must be full of elephant and giraffe in the rains. Rhinoceros are found between the Bahr el Homr and the Bahr el Arab. Lion are found in small numbers all over the south and south-west, and leopard are common in the hills, often doing much damage among the sheep and goats. Cheetah and several kinds of wild cat are also found. Pig and wart-hog occur in the south, and hares are found everywhere.

During the rains, duck, teal, and geese swarm on all open water. Except in the extreme north, guinea-fowl are found everywhere, and at certain times of year sand-grouse come in large numbers. The greater bustard, francolin, and partridge are fairly generally distributed. Ostriches are found in all the more uninhabited parts, but, owing to the thick bush, their feathers are worth little. In Dar Homr the birds are caught young and sold to the Hamars, who keep them in zeribas for the sake of their feathers. The Arabs hunt whenever they can, but have few rifles. The Nubas, however, who own many rifles, have driven nearly all the game out of their country. In such a huge area it is nearly impossible to enforce the game laws.

From the above account, it will have been seen that Kordofan is fairly rich as countries go in the middle of Africa. The revenue is now about £E60,000, and the expenditure £E35,000 a year, so that it can pay its way and contribute its share to the Central Administration. Ten years ago most of the villages had ceased to exist, and the few remaining inhabitants were living in extreme poverty. The majority of the Arabs had fled to other parts of the Sudan, and only returned after the Khalifa's death. It will, however, be a generation or more before the enormous losses from battle and famine can be replaced, though there is now no tribe which cannot be described as fairly well off.

THE CYCLE OF MOUNTAIN GLACIATION.*

By Prof. WILLIAM HERBERT HOBBS, University of Michigan.

The alimentation of glaciers is dependent upon the amount of precipitation and upon the temperature, the former being in large measure determined by the adaptability of the relief for local adiabatic and contact refrigeration of the air. The important factor, temperature, while a function of many variables, yet in a broad way varies directly with latitude and altitude. The size and the form of glaciers is, however, determined not solely by nourishment (mainly in the higher levels), but also to some extent by losses (particularly in the lower levels). In the main, however, the losses are controlled by the same factors as the gains, and maintain to them a determinate proportional relationship. Exceptions to this definite proportion occur when in high latitudes the glacier is attacked directly by the sea (tidewater glaciers), when it is suddenly melted by the heat of a volcanic eruption (Icelandic Jokŭls), or when disturbed by a heavy earthquake (Muir glacier in 1899). In form glaciers will be in large degree determined by the existing topography of the upland, which may generally be assumed to be some product of sub-aërial erosion. Starting, therefore, with the puny glaciers of arid regions in low latitudes, and ending with the high latitude glaciers within areas of excessive precipitation, we run almost the whole gamut of glacier alimentation.

The initial forms of glaciers may be described as snowbank, "newborn" or nivation glaciers, and will at first be few in number and located with wide intervening spaces of upland. The continuance of the nivation process will deepen other intermediate small depressions upon the upland, so that with increasing snowfall additional glaciers will appear in the spaces between the first as the latter are developing their amphitheatres. These cirques, at first no wider than the valleys below, will later cut recesses on either side at the same time that the glacier is pushed farther down the valley and occupies its bed to a greater and greater depth. The grooved upland of this stage, through additional cirque recession in the highlands and through abrasion and plucking in the intermediate levels, becomes at last transformed into the fretted upland, with its network of projecting comb-ridges. Up to this point the glacier ice has perhaps been restrained within valleys, which it has discovered and has progressively widened and deepened. If the initial temperature continues to be lowered, there must come a time when the ice feet from the better-nourished glaciers, or from those with the shortest route to the foreland fronting the range, will debouch upon the plain, spreading as they do so into fans or aprons (see Fig. 21).

* Continued from p. 163.

FIG. 21.—EXPANDED FORE-FOOT OF THE FOSTER GLACIER, ALASKA.

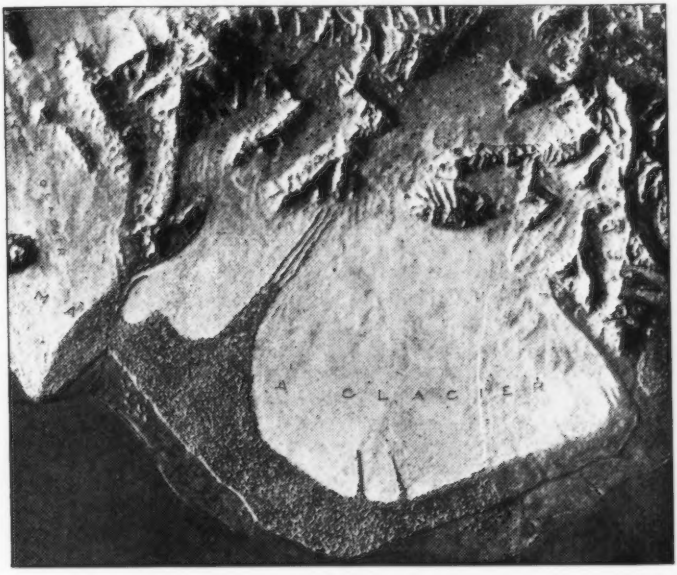

FIG. 22.—TYPE OF PIEDMONT GLACIER.

(From a photograph of the new model of the Malaspina glacier made under the direction of Lawrence Martin.)

FIG. 27.—A HANGING TRIBUTARY VALLEY MEETING A TRUNK GLACIER VALLEY ABOVE THE PRESENT WATER-LEVEL ON THE "INSIDE PASSAGE" TO ALASKA.

FIG. 28.—A HANGING GLACIERET, THE TRIEST GLACIER, ABOVE THE LOWER STRETCH OF THE GREAT ALETSCH GLACIER, SWITZERLAND.

Later all neighbouring glaciers may arrive at this stage, and by spreading upon the foreland, coalesce with one another to form a single broad apron, such as may be seen in the Malaspina glacier of Alaska. While the glaciers are thus pushing out upon the foreland they have been deepening in their valleys, and eventually come to overtop portions of the lateral comb-ridges of the fretted upland, thus moulding the sharpened needles into rounded shoulders of rock. In places the glaciers from adjacent valleys will flow together through the irregular depressions, separating peaks and producing islands or *nunataks*.

But the increased size of the individual glaciers of the range has corresponded to increased activity of cirque recession in the high altitudes, and this has resulted in the formation of cols or passes through the range. Snow which has been divided at the summit, as has water by a divide, may now be consolidated into glacier ice over the col before the separation is made. Thus it comes about that without a definite cirque, glaciers will transect the range flowing in opposite directions from a central icefield. Such a broad central icefield is found to-day between Mount Newton of the St. Elias group and Mount Logan to the eastward.*

The advance of the glacier ice up the sides of the valleys, so as partially to submerge the lateral comb-ridges, may not end until all are thus covered and the ice flows away from the central broad area, radiating in many directions. Here the process of cirque recession, which has mainly sculptured the rock in the higher altitudes, comes to an end as we reach the ice-cap stage of glaciation. Transitions toward such ice-cap glaciers are to be found to-day in the Elbruz and in the Kasbek region of the Caucasus, as well as in the Justedalsbräen of Norway, where a central elevated snow-field (fjeld) is the common *névé* of several glaciers radiating in as many directions.† It is of considerable interest to note that in the Caucasus district, at least, there is evidence that rocky comb-ridges are submerged beneath the ice and make their appearance so as to separate the marginal ice-tongues. The persistence of an ice-cap over a mountain region, as is clear from study of the glaciated mountains in Norway, tends to largely obliterate relief forms characteristic of mountain glaciers as they are replaced by the rounded shoulders of *roches moutonnées*. As soon, however, as nourishment has been so far reduced that the higher points once more appear from beneath their snow cover, cirque recession will begin again, and if long continued the evidence of the ice-cap will disappear. Lack of glacial scratches or polish in uplands sapped by this process should not be allowed to weigh too heavily in reconstructing the glacial history of the district.

* Filippo di Filippi, 'The Ascent of Mount St. Elias (Alaska),' by H.R.H. Prince Luigi Amadeo di Savoia, Duke of the Abruzzi (English translation). Panorama at end of volume (unnumbered) from an elevation of 16,500 feet.

† H. Hess, 'Die Gletscher. Braunschweig,' 1904, pp. 65–68.

Classification of Glaciers based upon Comparative Alimentation.

Relation of Glacier to its Bed.—From what has been said in the preceding section concerning the changes of glaciers in correspondence to a progressive augmentation of glacial conditions, it must be evident that any attempt to use each circumscribed body of snow and ice as a unit in name or in type will lead to endless confusion. Ice bodies being extremely sensitive to changes in annual temperature, a difference of one degree may be sufficient to join many ice bodies into one, or to differentiate one body into many. If, however, we examine the distribution of snow and ice masses within the valley which they either wholly or partially occupy, it will be seen that there are relatively few distinct glacier types, and that the coalescence of smaller ice masses, or the breaking up of larger ones, does not necessarily alter the type exemplified.

The more important types called for by analysis on this basis do not differ greatly from those adopted by Chamberlin and Salisbury,* which seem to be the ones most generally recognized. The genetic relationships of these types are here first brought out, together with distinct and intermediate transitional forms. In the following table, excepting the initial type and the glaciers with inherited basins, the arrangement is in the main one of decreasing alimentation:—

Nivation type (Bighorn glaciers).
Ice-cap type (Jökulls of Iceland).
Piedmont type (Malaspina glacier).
Transection type (Yakutat glacier).
Expanded-foot type (Davidson glacier).
Valley type, normal subtype (Baltoro glacier).
  Hanging glacierets (Triest glacier).
  Cliff glacierets (Lefroy cliff glacieret).
Valley type, Tide-water sub-type (Harriman-Fjord glacier).
Inherited basin type (Illecillewaet glacier).
  Reconstructed type (Victoria-Lefroy glacier).
  Volcanic cone type (Nisqually glacier).
  Cauldron type (Caldera glacier).
Alpine type (Nicolaithal glacier).
Horseshoe type (Mount Lyell glacier).

Nivation Type.—This type of glacier has also been called "new-born" or "snowbank" glacier, and represents the initial stage of glaciation. Though small in size, such glaciers differ markedly from those of the same dimensions which cling to the steep walls of a large cirque (see horseshoe glaciers below), and which Tarr has referred to as "dying glaciers."† Numerous examples of snowbank glaciers are furnished by the Bighorn mountains of Wyoming. Other known types of mountain glaciers are all represented, and follow naturally in sequence during a receding hemicycle of glaciation. In their discussion we shall conceive

* 'Geology,' vol. 1, chap. v.

† R. S. Tarr, "Valley Glaciers of the Upper Nugsuak Peninsula, Greenland," *Am. Geol.*, vol. 19, 1897, p. 265 and fig. 2.

a mountain district to pass by slow stages from a culmination of glacial conditions toward a comparatively genial climate.

Ice-cap Type.—Though in form and general characters resembling so-called continental glaciers, the ice-caps by reason of their smaller dimensions form a connecting-link with mountain glaciers, and are usually developed upon small plateaus or uplands. They correspond to conditions of extremely heavy snow precipitation, and in consequence have not been found fully developed outside the Polar regions (see inherited basin glaciers below).

The normal type of ice-cap glacier is represented by the mantle over Redcliff peninsula, north of Inglefield gulf in Greenland.* It suffers no interruption from mountain peaks, but the ice creeps out in all directions from a central area, and sends out marginal lobes or tongues which much resemble, save for their whiter surface, the snouts of valley and alpine glaciers (see below). The Jökulls of Iceland are very similar, and form flatly arched or undulatory domes of ice having short lobes about their margins (see Plate II., Fig. 1). The largest of these, the Vatnajökull, has an area of 8500 square kilometres.† In Scandinavia the small plateau glaciers with marginal tongues of proportionately greater length, such as the Justedalsbräen, serve to connect this type with that of the valley glaciers (see Plate II. Fig. 2).‡ The *Richtofenein* on Kerguelen island, recently described by the German South-polar Expedition, seems to be very similar.§ According to Meyer, the ice-mass upon the summit of Kilimandjaro in Africa is an "ice carapace," having much resemblance to the ice plateaus of Scandinavia.‖

Piedmont Type.—Piedmont glaciers, like ice-caps, correspond to conditions of exceptionally heavy precipitation, and are only known from polar and sub-polar regions. In contrast to ice-caps, the existing examples are found in connection with mountains of strong relief, so that the snow and ice which in ice-caps find their way slowly out to the margin of a flat or gently sloping plateau, are in the piedmont glacier discharged through valleys from lofty highlands to debouch upon the foreland at the foot of the range. The well-known type is the Malaspina glacier of Alaska, explored and described by Russell (see Fig. 22 and Plate II. Fig. 3).¶ Near it and farther to the west is the

* T. C. Chamberlin, "Glacial Studies in Greenland," IV., V., *Jour. Geol.*, vol. 3, 1895, pp. 199, 470.

† Th. Thoroddsen, "Island, Grundriss der Geographie und Geologie. V. Die Gletscher Islands," *Pet. Mitt.*, Erg. Bd. 32 (Nos. 152–153), 1906, pp. 163–208, map, pl. xii.

‡ H. Hess, 'Die Gletscher' (Map 3).

§ Emil Werth, 'Aufbau und Gestaltung von Kergulen. Sonderabd. aus Deutsch. Südpolar Expeditionen, 1901–1903,' vol. 2, pp. 93–183, pls. 9–14, 3 maps.

‖ Hans Meyer, 'Der Kilimandjaro, Reisen und Studien,' pp. 436. Berlin, 1898 (reviewed by Rabot).

¶ I. C. Russell, "An Expedition to Mount St. Elias," *Nat. Geogr. Mag.*, vol. 3, 1891, pp. 52–204, pls. 2–20. See also Filippi, *loc. cit.*

PLATE II.—TYPES OF MOUNTAIN GLACIERS.

Fig. 1.—Ice-cap type, Vatnajökull, Iceland. (After Thoroddsen.)
Fig. 2.—Ice-cap type, Justedalsbræen, Norway. (After Hess.)
Fig. 3.—Piedmont type, Malaspina glacier, Alaska. (After Russell and Kerr.)
Fig. 4.—Valley type, Baltoro glacier, Karakorum Himalayas. (After W. M. Conway.)
Fig. 5.—Valley type, Tasman glacier, New Zealand. (After v. Lendenfeld.)
Fig. 6.—Valley type (Tidewater glacier), Harriman fjord glacier, Alaska. (After Gannett.)
Fig. 7.—Alpine type, Nicolaithal glacier, Alps. (After Baedeker.)
Fig. 8.—Alpine type, Mer de Glace, Alps. (After Baedeker.)
Fig. 9.—Alpine type, Rathong glacier, Kangchengunga Himalayas. (After Garwood.)
Fig. 10.—Horseshoe type, Lhonak glacier, Kangchengunga Himalayas. (After Garwood.)
Fig. 11.—Horseshoe type, Asulkan glacier, Selkirks. (After A. O. Wheeler.)
Fig. 12.—Horseshoe type, Wenkchemna glacier, Canadian Rockies. (After A. O. Wheeler.)
Fig. 13.—Horseshoe type, Arapahoe glacier, Colorado. (After Fenneman.)
Fig. 14.—Inherited basin type, Great Aletsch glacier, Alps. (After Baedeker.)
Fig. 15.—Inherited basin type, Illecillewaet glacier, Selkirks. (After A. O. Wheeler.)
Fig. 16.—Inherited basin type (reconstructed glacier), Victoria glacier, Canadian Rockies. (After Scherzer.)

Bering glacier of about the same size.* To the east of the Malaspina glacier is the Alsek, a much smaller piedmont glacier.† In Chili south of 42° S. lat. are found other piedmont glaciers, among them the San Rafael.‡ During Pleistocene times piedmont glaciers existed in many mountain districts, notably, however, the Alps § and the Rocky mountains of North America.‖ A transition from the piedmont type toward the continental glacier is illustrated by the Friedericksshaab glacier in Greenland, which pushes its front out upon the foreland as an extension of the inland ice of that continent.

Above the ice apron and within the range, the piedmont glacier bears a close resemblance to the valley type (see below), though in general it may be said that its valleys are filled to a much greater depth. The largest stream feeding the fan of the Malaspina glacier has

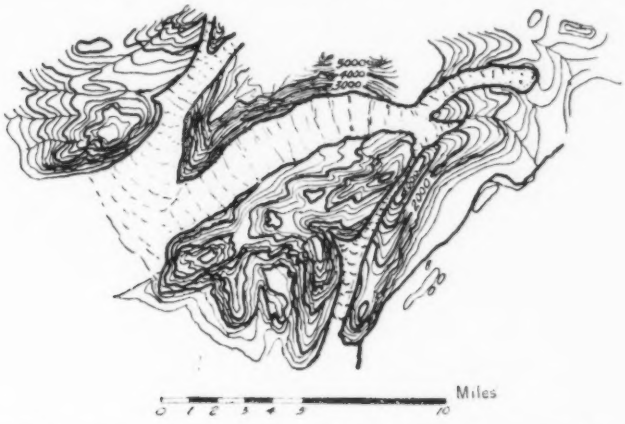

FIG. 23.—MAP OF A TRANSECTION GLACIER. THE SHERIDAN GLACIER NEAR THE COPPER RIVER IN ALASKA. (AFTER G. C. MARTIN.)

been named the Seward glacier, while other tributaries are known as the Agassiz and the Tyndall (see Fig. 2, Plate III.). It is interesting to note that however steep these feeders to the ice-apron may be, the

* Roughly outlined on map of Alaska to accompany "The Geography and Geology of Alaska," by Brooks (Prof. Pap. U.S. Geol. Surv., No. 45, 1906, plate in cover). For details of marginal portion and description, see G. C. Martin, 'Bull. 335 U.S. Geol. Surv.,' 1908, pp. 46–48, and pls. i., ii. and v.

† E. Blackwelder, "Glacial Features of the Alaskan Coast between Yakutat Bay and the Alsek River," *Jour. Geol.*, vol. 15, 1907, pp. 428–432, map.

‡ See Rabot, 'La Géographie,' vol. 3, 1901, p 270. See also Hess, 'Die Gletscher,' p. 63.

§ Penck u. Brückner, 'Die Alpen im Eiszeitalter, especially vol. 2, 1909, map opposite p. 396.

‖ Fred H. H. Calhoun, "The Montana Lobe of the Keewatin Ice-sheet" Prof. Pap. No. 50, U.S. Geol. Surv., 1906, pp. 14–21, map pl. i.

latter always shows an exceedingly flat slope, and is, moreover, relatively stagnant.

Transection Type.—In a late stage of augmenting glacial conditions or in an early stage of the receding hemi-cycle, what is essentially one body of ice may be divided over a pass and flow off in opposite directions toward different margins of the range. For this type, exemplified by the nunatak glacier of Alaska, Tarr has used the term "through glacier," * and Blackwelder has instanced the Yakutat glacier and perhaps the Beasley within the same region.† Such glaciers, which may be referred to as the *transection type*, are often the highways which give readiest access to the hinterland. A glacier of this type, which has been carefully mapped, is the Sheridan glacier near the mouth of the Copper river in Alaska (see Fig. 23).‡ An excellent panorama of one of the grandest transection glaciers has been furnished by Sella.§ The glaciation of the Grimsel pass in Switzerland clearly indicates that at one time a glacier of this type was parted over the present divide, one stream passing down the Rhone valley, and the other down the Häsli valley toward Meyringen. Far greater exhibits of the same sort are to be found in the Southern Andes.‖

Expanded-foot Type.—When a piedmont glacier draws in its margin as it shrinks with the coming of a warmer climate, the several ice-streams which feed the apron of ice upon the foreland end in small fans at the mouths of the individual valleys. Perhaps the best known example of such an expanded-foot glacier is the Davidson, on the Lynn canal in Alaska, though the Foster and Mendenhall glaciers of the same district are similar (see Fig. 22). The Miles and Childs glaciers, near the Copper river, are also of this type, and have been mapped by Martin (see Fig. 24 *a*).¶ The transection glacier known as the Sheridan is in the same vicinity, and has an expanded forefoot—a good illustration of the combination of these two types in one (see Fig. 23). A larger example of the expanded forefoot than any thus far mentioned is the Klutlan, in the Yukon basin, whose foot extends a number of miles beyond the front of the St. Elias range (see Fig. 24 *b*).** The Martin river glacier in the Copper river district affords another example, since it expands for a distance of over 20 miles. It is, however, partially restrained by a range of hills rising on its southern margin, and by

* *Bull. Am. Geogr. Soc.*, vol. **38**, 1906, p. 149. See also Prof. Pap. No. 64, U.S. Geol. Surv., 1909, pp. 35-36, 105, pls. vii.–viii.

† *Jour. Geol.*, vol. **15**, 1907, p. 432.

‡ G. C. Martin, 'Bull. 284, U.S. Geol. Surv.,' 1906, pl. 12.

§ Filippi, *loc. cit.*

‖ Argentine-Chilian boundary, maps.

¶ G. C. Martin, *loc. cit.*

** C. W. Hayes, "An Expedition through the Yukon District," *Nat. Geogr. Mag.*, vol. **4**, 1892, pp. 152. See also map of Mc[illegible]hall and Schrader, Prof. Pap. U.S. Geol. Surv., No. 15, 1903, fig. 4, p. 41.

Martin has been considered intermediate between the piedmont and valley types.*

Valley or Dendritic Type.—Retiring within the range as warmer temperatures succeed to more rigorous conditions, glaciers are of necessity restricted to individual valleys and their tributaries. They come thus to have a plan as truly arborescent as that of water-drainage, and they may in this stage be called dendritic or valley glaciers. Unfortunately, the term "valley glaciers," in every way appropriate, has been generally applied to glaciers which occupy valley heads only, and hence the term must be redefined in its natural rather than its inherited

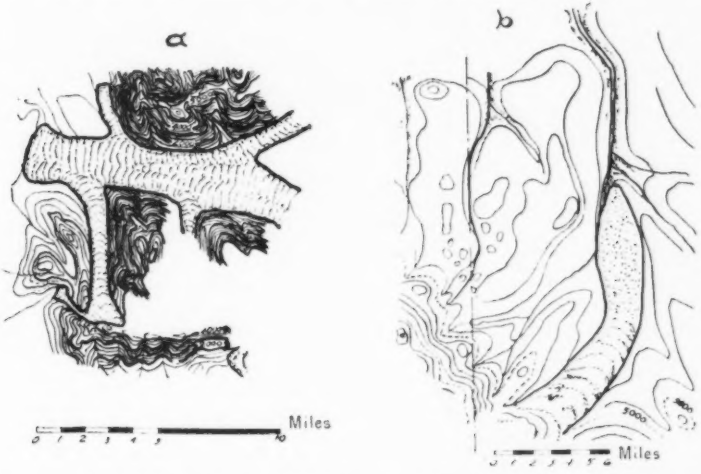

FIG. 24.—(*a*) MAP OF THE MILES GLACIER IN ALASKA (AFTER G. C. MARTIN); (*b*) MAP OF THE KLUTLAN GLACIER IN THE YUKON BASIN OF ALASKA (AFTER MENDENHALL AND SCHRADER).

significance. This glacier type geographers are most familiar with in restorations of Pleistocene glaciers,† but it is none the less a common form to-day in districts more distant from commercial centres, and hence less easily accessible for study. From the Karakoram Himalayas, the Baltoro, Hispar, and Biafo glaciers, all of this type, have been described and carefully mapped by Sir Martin Conway.‡ An outline map of the Baltoro glacier is reproduced in Plate II. Fig. 4, and one of the Hispar glacier in Fig. 25. Other valley glaciers, generally less extensive, have

* G. C. Martin, "Geology and Mineral Resources of the Controller Bay Region, Alaska," Bull. No. 335, U.S. Geol. Surv., 1908, pp. 48–49, pl. i., ii., and v.

† One of the best maps of such a restored valley glacier of Pleistocene age is that of the Kern valley of California (see Lawson, *loc. cit.*, pl. xxxi.).

‡ W. M. Conway, 'Climbing and Exploration in the Karakoram Himalayas,' maps and scientific reports. 1894.

been mapped by Garwood * from the Kangchenjunga Himalayas. In the Central Tian Shan mountains are other glaciers of this type.† In

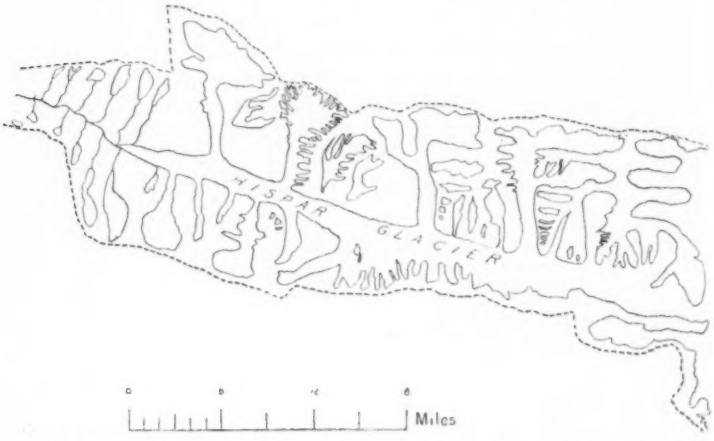

FIG. 25.—OUTLINE MAP OF THE HISPAR GLACIER, KARAKORAM HIMALAYAS. (AFTER CONWAY.)

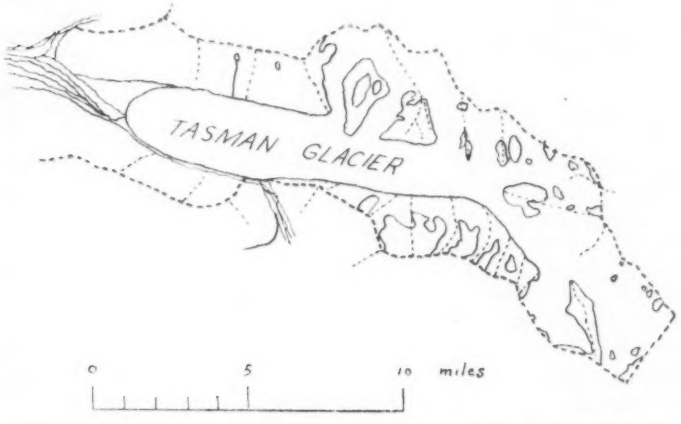

FIG. 26.—OUTLINE MAP OF THE TASMAN GLACIER, NEW ZEALAND. (AFTER V. LENDENFELD.)

* E. J. Garwood, "Notes on Map of the Glaciers of Kangchenjunga, with Remarks on some of the Physical Features of the District," *Geogr. Journ.*, vol. 20, 1902, pp. 13–24, plate.

† Max Friederichsen, "Die heutige Vergletscherung des Khan-Tengri-Massives und die Spuren einer diluvialen Eiszeit im Tiën-schan," *Zeit. f. Gletscher K.*, vol. 2, 1908, pp. 242–257.

the New Zealand Alps the Tasman glacier furnishes another example of the same valley type* (see Fig. 26 and Plate II., Fig. 5). Still other examples have been described from the mountains of Alaska, such, for example, as the Kennicott and Chistochina glaciers.†

Comparison of a number of examples of valley glaciers may illustrate as many different stages in the retreat of the glacier from a position in which it occupied its entire valley to the retirement almost within the mother cirque at the head. The examination of the vacated valley has taught us that the tributary glaciers erode their beds less deeply than the trunk stream lying in the main valley. It is the surfaces of the ice-streams only that are accordant, and hence a lack of accordance in the bed-levels has yielded the so-called hanging valleys with their characteristic ribbon falls. Nowhere can the hanging valleys be observed in greater perfection or on a grander scale than in the troughs, now largely abandoned of ice which enter the great fjords of the "inside passage" to Alaska (see Fig. 27).‡

As the foot of the trunk glacier retires up its valley, the lateral tributaries which are nearest the mouth of the valley are at first separated from it and develop their own front moraines. Later they are left high above the main stream as a series of *hanging glacierets* (see Fig. 28).§ The series of hanging glacierets, as will be observed in the maps of the Baltoro and Hispar glaciers, often persist above the main valley well below the foot of the trunk stream.

Inherited Basin Type.—The valley type of glacier hardly appears in the Alps at all, though the Great Aletsch glacier might perhaps be regarded as a small and imperfect example. The size and characters of the latter are, however, for the district in which it lies, abnormal and to be accounted for by the existence of a natural interior trough lying between the Berner Oberland on the one side and the high range north of the Rhone valley upon the other, from which basin small outlets only are found through the southern barrier (Plate II. Fig. 14). A

* R. v. Lendenfeld, "Der Tasman Gletscher und Seine Umrandung," *Pet. Mitt.* Erg. Bd., vol. **16**, 1884, pp. 1–80, map, plate I.

† W. C. Mendenhall and F. C. Schrader, "The Mineral Resources of the Mount Wrangell District, Alaska," Prof. Pap. U.S. Geol. Surv., No. 15, 1903, pl. iv. and ix. See also Brooks, Prof. Pap. U.S. Geol. Surv., No. 45, map, plate xxxiv.

‡ R. S. Tarr, "Glacier Erosion in the Scottish Highlands," *Scot. Geogr. Mag.* vol. **24**, 1908, pp. 575–587.

§ The term "hanging glacier," now used in a variety of senses, is, it is believed, best retained with this restricted meaning. The term "cliff glacier," generally considered synonymous, may be restricted to the long strips of incipient glacier ice which sometimes parallel the main valleys on narrow terraces above precipitous cliffs which are primarily determined by the rock structure (see *ante*, p. 154; and also Matthes 'Appalachia,' vol. **10**, 1904, p. 262). In the sense here employed, a hanging glacier is the equivalent of the *Kahr Gletscher*, a term quite generally employed in Germany. The term "horseshoe" glacier we have here suggested for an essentially different type of glacieret (see below, p. 280).

better example, however, of this special type of glacier, in which the inherited topography has exercised a greater influence upon the glacier form than has the auto-sculpture, is furnished by the Illecillewaet glacier of the Selkirks (see Fig. 29), which, from a roughly rectangular

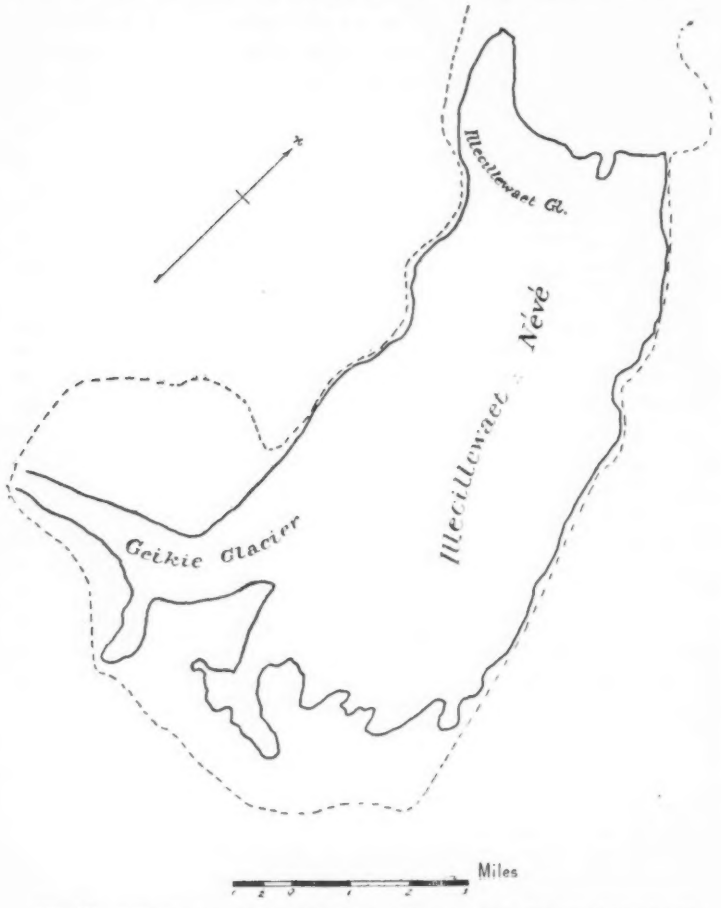

FIG. 29.—OUTLINE MAP OF AN INHERITED BASIN GLACIER, THE ILLECILLEWAET GLACIER OF THE SELKIRKS. (AFTER WHEELER.)

snow-icefield lying between parallel ridges, sends out short tongues leading in different directions. A glacier of this type, with a moderate increase only of alimentation, would produce a small ice-cap.

Another abnormal form of glacier due to the peculiarities of the basin which it inherited, is illustrated by the Victoria glacier in the

Canadian Rockies, a glacier having no cirque, but only a couloir (the so-called "death-trap") in its stead (see Fig. 30). In this case the *névé* which feeds the glacier is found high above upon the cliff—a true cliff glacieret—and this *névé* avalanches its compacted snow upon the surface of the Victoria glacier, which thus well illustrates the *reconstructed type.**

Again, glaciers may develop, not upon a gently domed and variously moulded pre-glacial upland such as we have thus far had under consideration, but upon the sharply conical volcanic peaks which in temperate and tropical regions push their heads from the mountain upland far up above the snow-line. In such cases, regular cirques cannot develop at the heads of the radiating ice-streams, but, on the contrary, very irregular and mutually destructive forms will result (see Fig. 31).† This is the more true because of the loosely consolidated tuffs of which such cones are always built up. If sufficiently lofty, the result may be a small carapace or ice-cap such as is found to-day upon the summit of Kilimandjaro in Africa. On the other hand, a partially ruined crater may furnish a *natural* basin or cauldron for a small glacier—*Cauldron Type.*‡

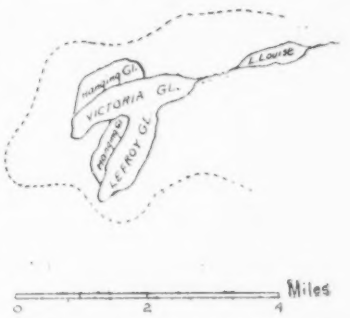

FIG. 30.—OUTLINE MAP OF RECONSTRUCTED GLACIER—THE VICTORIA AND LEFROY GLACIERS IN THE SELKIRKS. (AFTER WHEELER.)

Tide-water Type.—In high latitudes glaciers sometimes descend to the level of the tide-water in fjords which continue their valleys. In such cases, the glacier front is attacked mechanically by the waves and is further melted in the water. In place of the convexly rounded nose, so characteristic of the other types, there develops a precipitous cliff of ice from which bergs are calved, and the glacier front in consequence is rapidly retired (Plate II. Fig. 6). Unhappily, the local term "living glaciers" has been applied to this type in Alaska; "dead glaciers," in the same usage, being applied to glaciers which yield no icebergs. The slopes of the glacier surface and the measure of projection of the ice above the water-level both render it probable that in most cases, at least, the ice-foot everywhere rests on a solid basement.

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* See map and description of this glacier by Scherzer, "Glaciers of the Canadian Rockies and Selkirks," Smith Contrib., No. 1692, 1907, chaps. 2-3.

† Cf. I. C. Russell, "Glaciers of Mount Ranier," 18th Ann. Rept. U.S. Geol. Surv., 1898, pp. 329–423.

‡ Hans Meyer, "Der Calderagletscher des Cerro Altar in Equador," *Zeit. f. Gletscherk.*, vol. 1, 1906–7, pp. 139–148.

On the other hand, the Turner glacier, debouching into Disenchantment bay, Alaska, shows a flat and relatively low front section, which is separated from the remaining and sloping portion of the glacier by a steep ice-fall. This has led Gilbert to think that the lowest terrace is floated in the water.*

Alpine Type.—A good deal of misunderstanding is current in regard to alpine glaciers, often unhappily referred to as valley glaciers. Examination of any good map of Switzerland suffices to show that with the possible exception of the Great Aletsch, an abnormal type, Swiss glaciers hardly extend into valleys at all. We have too long held the alpine glacier close before the eye, and so have much exaggerated its importance. When Alaskan, Himalayan, and New Zealand glaciers are brought into consideration, the real position of the Swiss type becomes apparent. In reality the glaciers of the Alps, far from occupying valleys, do not even fill the mother cirques at the valley heads. Here they lie, side by side, joined to one another like the radiating sticks within a lady's fan, for which reason they have been called *Zusammengesetzte Gletscher* (see Fig. 10 and Plate II., Fig. 7). The *mer de glace*, next to the Great Aletsch the largest in Switzerland, with its numerous tributaries, it is true, completely fills a cirque, but only that of a tributary valley (Plate II. Fig. 8).† Alpine glaciers are hence sheaves of small glaciers which are wholly included within the mother cirques, or which fill and extend out from the secondary or tributary cirques. In the Nicolai Valley of Switzerland, the Gorner glacier and its several tributaries (see Fig. 10), with the Findelen and Längenfluh, the Theodul, Furgen, and Z'Mütt glaciers together, but partially fill the mother cirque of which Zermatt is the centre. Lining the valley below upon either side are eighteen to twenty glacierets, all resting upon the *albs*, or high mountain meadows.

High up in the Chamonix valley, below the debouchure of the *mer de glace*, similar glacierets are lodged upon the ledge below the sharp needles of de Charmoz, de Blatière, du Plan, and du Midi, their frontal moraines making a continuous series of scallops above the shoulder of the valley. Similar but smaller series are shown in Figs. 20 and 32.

Horseshoe Type.—The final representative type in our series, unlike the alpine glacier, is no longer made up of streams joined together in

* G. K. Gilbert, 'Harriman Alaska Expedition,' vol. 3, "Glaciers," 1904, pp. 67–68. See also Tarr, "The Yakatat Bay Region, Alaska, Physiography and Glacial Geology." Prof. Paper No. 64, U.S. Geol. Surv., 1909, pp. 39, 40, pl. x*a*.

† This valley is a large hanging valley tributary to the Chamonix valley, which latter alone is comparable in size to those that form the beds of the Baltoro, Hispar, and Tasman glaciers. If at first it seems that confusion may result from the introduction of valleys of different orders of magnitude, a second thought suffices to show that the difficulty is of theoretical rather than of practical importance, at least so far as existing examples of glaciers are concerned.

FIG. 31.—IRREGULARLY BOUNDED NEVÉS UPON THE VOLCANIC CONE OF MOUNT RANIER.

FIG. 32.—SERIES OF HANGING GLACIERETS WHICH EXTEND THE ASULKAN GLACIER IN THE SELKIRKS.

FIG. 33.—VIEW OF THE ASULKAN GLACIER, A HORSESHOE GLACIER IN THE SELKIRKS.

FIG. 35.—VIEW LOOKING DOWN THE VALLEY OF FISH CREEK FROM THE ASULKAN GLACIER, THE HERMIT RANGE IN THE DISTANCE. SELKIRK MOUNTAINS.

FIG. 37.—VIEW OF THE WENKCHEMNA GLACIER AT THE HEAD OF THE VALLEY OF THE TEN PEAKS IN THE CANADIAN ROCKIES.

sheaves. With further shrinking of alpine glaciers corresponding to higher air temperatures, the glacier front retires until it approaches the cirque wall. It now takes on, either as an individual or as a collection of small remnants, a broadly concave margin, which is in contrast to the convex or convexly scalloped front characteristic of all other glacier types. This type of glacieret has been sometimes described under the names hanging and cliff glaciers.* Reasons have been presented for restricting both these terms to special and different varieties

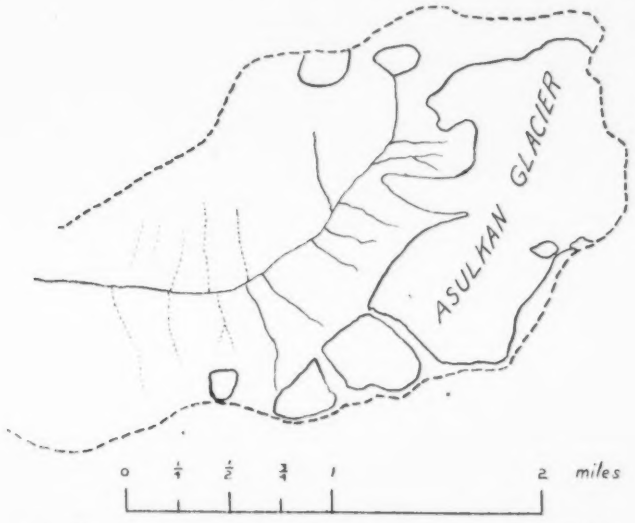


FIG. 34.—OUTLINE MAP OF THE ASULKAN GLACIER IN THE SELKIRKS.

of small glaciers or glacierets. It is proposed to use here the term "horseshoe glacier" for these last remnants of larger glaciers hugging the wall of the cirque. Most of the glaciers of North America outside of Alaska belong in this class. As already implied, they are generally broader than long, and usually have concave frontal margins. Excellent examples of this type are furnished by the "Horseshoe glacier" at the head of the Paradise valley in the Canadian Rockies and by the Asulkan glacier in the Selkirks (see Figs. 32–34.) The Mount Lyell glacier, long known and cited from the High Sierras of California, is, however, an equally good type.† For further illustration of the type the Wenkchemna glacier in the Canadian Rockies has been chosen (see

* See footnote on p. 277.

† I. C. Russell, "Existing Glaciers of the United States," 5th Ann. Rept. U.S. Geol. Surv., 1885, pp. 314–328, pl. 40.

Figs. 36, 37 and Plate II. Fig. 12). The Asulkan and Wenkchemna glaciers have both been described by Scherzer as belonging to the piedmont type. The former hugs the cirque wall with an incurving frontal margin, and is extended by a series of small hanging glacierets (see Fig. 32). Unlike the piedmont glaciers, it has no foreland on which to expand, but lies at the head of a typical U-shaped valley (see Fig. 35). The Wenkchemna glacier occupies a similar position in the great cirque outlined by the Ten Peaks at the head of a tributary valley to the Bow (see Figs. 36, 37).*

In Plate II. the various types of glacier are shown on approximately the same scale, and from this it will be appreciated that the size, directly dependent upon the alimentation of the glacier, must be a determining factor in classification. The ice-cap and piedmont glaciers will in this respect overlap, being differentiated by the accentuation of the relief of the land, though in the main the ice-cap is the larger. For the other types the proportion of the glacier-carved valley which is still occupied by the ice will determine the form and the more important characters of the existing glacier. It is important, therefore, in order to determine the type to which an individual glacier belongs, to map the divide surrounding the valley, as well as the boundaries of the glacier which lies within it.

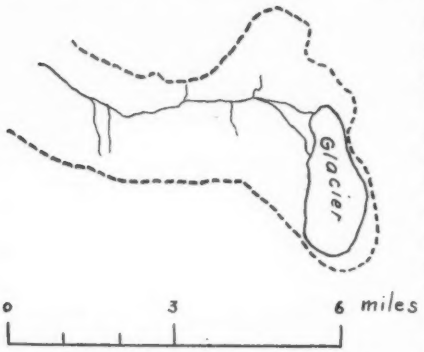


FIG. 36.—OUTLINE MAP OF THE WENKCHEMNA GLACIER IN THE CANADIAN ROCKIES.

Termination of the Cycle of Glaciation.

Configuration of the Glacier-bed when uncovered.—No one who has climbed a mountain glacier to its *névé* has failed to be struck by the alternation of plateau and precipitous slope, for the surfaces of mountain glaciers are, with few exceptions, broken into broad terraces. Each steep descent is well understood to overlie a corresponding fall in the glacier-bed. Perched upon the high cliffs which overlook the Pinnacle pass

* Sherzer, Smith Contrib., No. 1693, 1907, chaps. iv. and vii. The only resemblance to the piedmont glacier is in the shape. Neither glacier expands upon a foreland, but both lie in cirques at the heads of U-shaped valleys. They have no appreciable tributaries, and, as already pointed out, piedmont glaciers are necessarily of large size, corresponding to excessive precipitation.

during his first attack upon Mount St. Elias, the late Professor Russell wrote of these terraces *—

"Were the snow removed and the rock beneath exposed, we should find terraces separated by scarps sweeping across the bed of the glacier from side to side. Similar terraces occur in glaciated cañons in the Rocky mountains and the Sierra Nevadas, but their origin has never been explained. The glacier is here at work sculpturing similar forms, but still it is impossible to understand how the process is initiated."

The generalized description of uncovered glacier-beds within the High Sierras of California—perhaps as well as any that has been penned—lays the emphasis upon the more essential and impressive characters †—

"The amphitheatre bottom terminated forward in either a cross cliff or a cascade stairway, descending, between high walls, to yet another flat. In this manner, in steps from flat to flat, common enough to be characteristic, the canyon made descent. In height, however, the initial cross cliff at the head dominated all. The tread of the steps in the long stairway, as far as the eye could follow, greatly lengthened in down-canyon order."

The grade in the treads of the giant stairway is often reversed, so that they come to be occupied by the characteristic rock-basin lakes, long and ribbon-like, or strung along the valley like pearls upon a thread.

Since Russell's meditation above the Pinnacle pass, nearly a score of years ago, considerable study has been given to the subject of erosion upon the glacier-bed. In the Alps Penck and Brückner have enunciated their "law of adjusted cross-sections." The glacier, on invading the mature river-valley, characterized by uniformly forward grades and by accordance of trunk with side valleys, will, in general, be so modified that a small cross-section corresponds to a deepening of the valley.‡ Thus will be brought about the hanging side valley, and a local modification of, and perhaps even a reversal of, direction in the grade of the main valley.

If the rock be not homogeneous throughout, or if it be unequally intersected by joint planes, further abrupt changes in grade will result. The two processes which are effective in deepening the bed of the valley are well recognized to be abrasion and plucking. Greater softness in the rock will correspond to greater depth of abrasion, while the perfection of the parting planes will directly determine the amount of quarrying in the rock by plucking. Abrasion being greatest on the

* I. C. Russell, "Expedition to Mount St. Elias," *Nat. Geogr. Mag.*, vol. 3, 1891, pp. 132–133.

† Johnson, *Journ. Geol.*, vol. 12, 1904, pp. 570–571.

‡ A. Penck, *Journ. Geol.*, vol. 12, 1904, pp. 1–19.

upstream side of any irregularity in the bed, and plucking being largely restricted to the downstream side, the tendency of these processes working together will be to produce steps of flat tread but steep riser, the latter coinciding with the nearly perpendicular planes of jointing.

It is further probable that the cliffs at the lower margins of the terraces are in many cases, at least, considerably recessed through the operation of a sapping process in every way analogous to that which obtains at the base of the Bergschrund, or *Randspalte*. So soon as the rock-cliff has been formed, either below a narrowing of the valley or where a hard layer of rock transects it, the glacier will descend over it in an ice-fall, showing gaping transverse crevasses. These fissures in the ice may be sufficiently profound to admit the warm air at midday to the rock joints, and so bring about with the nightly fall of temperature a mechanical rending of the rock.

Basal cliff sapping being downward as well as backward, the reversed grades of the treads in the staircase could be thus explained. In the Alps, Penck distinguishes especially one larger cliff in the staircase which separates the head cirque from the trough valley (*Trogthal*).

Water-erosion within the Valley during Retirement of the Glacier.—The staircase left by the ice, with its rock-basin lakes high up in the valley and its morainal lakes in the lower reaches, undergoes a rapid transformation under the influence of running water so soon as the ice has largely vacated the valley. Flowing from the waning remnant of the glacier, this water is overburdened with sediment. Its current is sluggish on the treads of the steps, but develops a cascade over the cliffs between. The coarser *débris* which it carries is thus quickly dropped upon the treads to fill the lake-basins, and with the aid of the finer material, the rock obstructions are cut through in narrow cañons and with a marvellous rapidity. Where a barrier of more resistant rock has hemmed in a portion of the valley (*Riegel*), narrow picturesque gorges have been cut, such as the *Aarschlucht* and the gorge of the Gorner.* The lateral moraines, having slid down their slopes with the retirement of the ice, are rapidly buried under the talus of the rock-slides from the steep valley walls, thus partially obscuring the characteristic U of the valley section. Sufficiently clear marks are left, however, so that there is seldom serious difficulty in restoring the main outlines of the glacial history of the district.

* Some of the Swiss gorges were described by Tyndall ('Hours of Exercise in the Alps,' pp. 224–230).

A TOUR IN THE LIBERIAN HINTERLAND.

By Captain BRAITHWAITE WALLIS, F.G.S., F.R.G.S., His Majesty's Consul-General at Dakar, lately H.M.'s Consul-General for Liberia.

In the early part of 1908, having completed some pressing work at Monrovia, I made arrangements for an official tour in the interior of Liberia. The route lay from Monrovia to Sierra Leone by steamer (some 250 miles); from Freetown by railway to Baiama (some 220 miles), which place is within a few hours' march of the Anglo-Liberian frontier; and from this point on the boundary to march eastwards.

On April 18, 1908, I left Freetown by railway, reaching Baiama, near the frontier, on April 20. The following day I marched to Bariwalla, which, by looking at the map, will be observed to be within a short distance of the boundary. The caravan was made up as follows: twenty-five carriers with one head man, one head interpreter, one second interpreter, one cook, two personal servants, and one guide. Our battery consisted of three Lee-Enfield carbines and one pocket revolver.

On April 23, after crossing the frontier, we arrived at Vahun, in the Guma country, where we halted for the night. This part of Liberia is hilly, and the paths (there are no roads) are exceedingly bad. The forests, eating close into the scattered villages, appear gigantic and dense, and are inhabited by herds of elephants. On April 27, after a long march over the Kambui range, through swamps and along narrow tracks, we arrived at Kamatahun. The Kambui range divides the Mende from the Bande countries, and is a straggling group of wild, rugged, and forest-clad mountains. Baboons, leopards, the small leopard cat, and other animals abound in this forest; and the hills and gigantic rocks, with their caves and crevices, are believed by the natives to contain good and bad spirits. The place, in consequence, is regarded by them with suspicion and dread. The geological formation, to a great extent, consists of laterite, diorite, and ironstone. The latter, in places, caused me some trouble on account of the magnetic attraction, and the consequent erratic behaviour of the compass. The next day the caravan reached Sambatahun, and on April 30 we arrived at another Bande town, called Zigizu.

On the following day we arrived at Janne, in the Gorahun chiefdom of the Bande country. Here the paramount chief resides, and by him we were well received. He complained bitterly about "the war," with which, he stated, his towns and people were constantly being threatened. He spoke about the large war-town of Pandeme, in the Bunde country, which, he said, harboured thousands of fighting men known as Sofas. This place is a terror to the surrounding country, and is believed by the natives to be impregnable. It is supposed to be guarded by spirits,

* Map, p. 356.

and to possess a very powerful devil, who always renders victory assured, either in attack or defences, to the warlike inhabitants.

Pandeme, encircled by trees, is situated in more or less open country in a hollow, and is surrounded by hills, a splendid object for artillery fire. It is protected by many strong stockades, and within their walls live some of the greatest cut-throats in West Africa. All kinds of savage and barbarous customs take place in Pandeme. Life is held to be cheap there, as it often is in barbaric Africa, and human sacrifices are enacted. Large quantities of slaves are bought and sold. In fact, the object of most of the raids and the attacks of the Sofa warriors was the capture of slaves, and these forages extend over wide areas of country. Although Pandeme is within the tribal boundary of Bundeland, it belongs to no exclusive clan or tribe. It is likely that representatives of most of the people within the Liberian hinterland and adjacent territories live, or have lived there, either as fighting men or as captured slaves. Sofa is a native word meaning a collection of different peoples. The town seems to have been in existence and flourished for many generations; and tradition has it that it was noted as a war centre before the great-grandfather of Samore or Samadu was born, that celebrated Muhammadan warrior who gave the French such a lot of trouble in the Sudan. Samadu was, it may be remembered, captured unexpectedly by a small French column in the Liberian hinterland.

No white man seems to have ever visited Pandeme except Mr. T. J. Alldridge, I.S.O.,* who did so at some risk in 1898, when he was Travelling Commissioner in Sierra Leone. He was then engaged in making Treaties for the British Government with the various chiefs in the territories that, since August, 1896, have become part of the Protectorate of Sierra Leone. Pandeme was the limit of Alldridge's tour. In the journey described here, I passed close to it, but being pressed for time, I pushed on north-eastward towards Central Liberia, and then turned northwards to the French frontier.

The population of Janne is large, almost untouched by the so-called civilization on the coast. It is typical of Western Africa. The men, who are nearly all of the Bande (Gbandi) tribe, have fine physique and very black skins, and most of them plait their hair, which is worn about 6 inches to 8 inches long. They appeared to be well armed with rifles, guns, spears, and swords. While in this town I saw seven slaves, who were secured by the leg in wooden "stocks." They had been in that position for some months. One of them told me through the interpreter that he had been kept thus for two years. He was a man of poor physique, and a purchaser could not therefore be easily found for him. Throughout this hinterland, as has been before stated, slavery in its worst form is in a flourishing state, and one becomes painfully aware of

* See 'The Sherbro and its Hinterland,' by T. J. Alldridge.

the incongruity of the name "Liberia" when such scenes as these are met with. Nothing would have given me greater pleasure, just then, than to have cut these poor creatures' bonds and set them free, but I was, alas! powerless to act.

That night, while asleep in my little hut in the town, I was awakened by hearing a gentle chorus of women's voices singing some yards away. After a few minutes the chorus ceased, and a single voice began, in Bande, an African song. The voice was soft and melodious, and the tune was fascinating and weird, and harmonized with the wild environment to which it belonged. After a few lines, the other singers joined, and the result was most attractive and beautiful, containing as it did such delicate harmony with excellent taste. During the years I have been in Africa, I do not remember having heard anything quite like this singing before, and I shall never forget it. The interpreter told me the next morning that the song was to the good spirits, asking them to guard and protect the white man and his followers on their journey.

On the next day we left to continue the march eastwards, crossing the beautiful upper Lofa river just beyond Janne by a swinging hammock bridge, made of creepers, vines, and wood. This river divided the Gbandi and Bunde countries, for when over the bridge we had entered Bundeland, the place of the warlike Sofas. Owing to the vicinity of these people, the town of Malema, where we halted for the night, was strongly stockaded. There were no less than thirteen formidable war-fences round this town, and the carriers had considerable difficulty in squeezing their loads through the narrow apertures. A few yards outside the first stockade, I noticed an empty grave, the newly turned earth of which showed it had been recently dug. This grave, it appeared, had been used for the purpose of burying a man alive as a sacrifice; and I was informed in a most matter-of-fact way, and as if the occurrence was quite an ordinary one, that the unfortunate victim's body had been lately exhumed to obtain certain portions for the purpose of manufacturing fetish medicines.

The next day proved to be a hard march for the little caravan. Leaving Malema before dawn, we at once entered into a vast forest. Immense trees, creepers, and foliage of all sorts and conditions surrounded us on every side, and locked themselves over our heads, sometimes obliterating nearly all light. Roads there were none, only mere tracks, often not discernible amidst the varied tangles of undergrowth. In places the limbs of great trees and other obstacles lay right across the track, and sometimes even these were crushed and obliterated by the herds of elephant which abound. For these huge beasts, during their roamings, make roads like a carriage drive, scattering heavy obstacles about and uprooting large trees like mere wheat-awns from their sockets. Sometimes the carriers had to hack their way through this dense foliage, and

hew down the tall sharp-edged grass, which bit into the flesh like a knife whenever it came into contact with it. Sometimes they crept under a fallen tree, lying larger than some lightning-smitten oak across their track. At other times they had to disentangle themselves and their burdens from the huge and unyielding creepers, which seemed ever ready and savagely delighted to retard their hard-fought progress.

A large number of natives had gathered to meet us at Bué, which is a big town in the Zembe chiefdom of the Bunde country. It was brought home to one here that this was real Africa, quite untouched by the hand of European intercourse. Not a cloth, nor a spear, nor a sword, that was not of pure African make, was to be seen anywhere, with the exception of the guns and rifles. To the student of Africa, and those who are interested in the study of savage and primitive man, in the wonders of Nature, and in the botany, geography, and zoology of a little-known and unexplored country, the inconvenience of travel and the troubles of the day before were perhaps worth enduring. The fascination of the country steals upon one on such occasions, and the beauty of the wonderful forest and scenery, and the subtle attraction of being with a people who are living natural lives and as Nature so ordained, perhaps touches some dormant spot, which awakens the feeling that the somewhat artificial existence of Western civilization and the striving and the hurrying are not all that we were intended for. In this part of the great Dark Continent, and particularly in Western Africa, with its hidden mysteries and strength, fierce as a furnace and as unrelenting, men's minds dwell upon these things, and they sometimes feel most strongly the subtle fascination of their environment.

There was little or none of the Gbandi language spoken in the place, Bunde being the principal dialect. The town is a large one, and the ordinary wooden war-fence was not in existence. In its place, a high and thick mud and loopholed wall enclosed the town. It was made of a reddish-brown earth, and became very hard after exposure to the sun. The people appeared higher in the scale of African civilization than those in the lower Bande country, for Muhammadanism is finding its way very rapidly into Liberia from the north. The women, who wore their hair long, and decorated themselves with massive silver armlets, were of fine physique and not ugly to look upon. The men were equally fine, and had very black skins. They were, as usual, armed with guns, spears, and swords, and many of them were clothed with handsome cloths and gowns of pure African manufacture.

The forest through which we had passed the day before was, of course, full of many varieties of timber. *Khaya*, a species of mahogany, and the heavy camwood, had been obtained from it by the natives. I saw no teak (*Olfieldia*), although it probably exists in the neighbourhood, Rubber vines were in evidence, and this portion of the great forest probably contains quantities of rubber, as in other parts of Liberia.

Twenty-two different kinds of vines and trees produce rubber of various qualities, and no less than sixteen species of rubber have been classified. The *Funtumia africana* and the *Funtumia elastica* exist in the various belts, and its collection is popular among the Kpwesis, Susus, Beilas, Bundes, Mendes, Golas, Vais, Mandinsos, and other tribes in the Liberian hinterland.

As the rainy season was advancing, and there being little time to spare, we turned northwards and marched for a town called Zigida, which is not far from what has now become the French frontier. The paramount chief of the whole of this part of the Bunde country was then staying at this place, having been driven out of one of his towns further north by the French, with whom his fighting men had come in contact.

It was there that poor Doctor Voltz, the plucky Swiss explorer, was killed in 1906, during an attack by a French column. How the doctor actually met his death will probably never be known. Whether he was killed by the natives, or whether he fell a victim to some stray French bullet during the attack, there seems no evidence to show.

On May 7 we left in a north-easterly direction for a town called Barwoi. We had now entered the Buse country, and at this town we camped for the night. I had now to decide whether it would be advisable to risk journeying eastward and more or less parallel to the route we had already taken; or whether to proceed north-east to the nearest French outpost, which happened to be some six hours' march away. Hearing a report about an impending attack planned by the Buse people upon this outpost, this finally decided me to make for Sondeme, and warn the French of this proposed attack. On May 8 we reached the French post, and I was most cordially received by the acting commandant and other officers at this wild station. The French detachment only arrived in January, 1908, and had already done excellent work in building barracks and clearing the ground. A company of one hundred and five men, in command of a captain and two lieutenants, was stationed at the post. The other outposts, from west to east, were, Wulade,* Gouecked u, N'Zebala, and Gouke. (The spelling is French.)

The French officials could, however, tell me nothing about the country through which I wanted to pass, nor about its inhabitants, nor the routes. No European, nor, it appears, any "civilized" native (*i.e.* one wearing trousers and boots), seems to have passed through the country in the direction I wanted to go. The French officers thought it would be safe. I was anxious to go that way, as nobody else had. It was a more direct route to the British frontier, and would make a useful traverse, if the times and bearings could be correctly taken and

* At present occupied by a British force.

recorded. On May 10 the caravan started off for Barkame, in the Toma chiefdom of the Northern Bunde country, at which place it arrived after a 7½ hours' journey. The natives appeared a savage-looking lot, and all armed.

On the 11th we started off for a town called Koinjama. This place is in the Barru chiefdom of the Bunde country. Crowds of armed and savage men turned out to meet us on the road, but nearly everywhere, up to the present, we had been fairly well received. On May 12 we continued the westward journey. But from now onwards our difficulties commenced, for the little caravan had unwittingly entered into hostile territory. The young chief of Barkame, who had accompanied us to Koinjame, changed the guide at the latter town. About half an hour from a large town called Betiema, in the Barru country, the carriers were prevented by armed natives from entering and passing through a small village, which was about a quarter of a mile in front of another large town. Our new guide appeared to be very angry at this, and having found the headman, the headman stated that he had no power to allow strangers to pass through his village, adding that it was against the law of the country, and could not be permitted. He, however, volunteered to show us a way round. We were therefore led by a circuitous route over bad country where no paths existed, for about an hour, by which time the caravan had made a large semi-circular *détour* round the village and the large town at the back of it. The guide, who was accompanied by his brother, then asked me to wait while he went back to find and interview the chief, ascertain the cause of the trouble, and obtain a guide to show us on to the next country. We waited and waited, until two hours had passed, but no guide appeared. Meanwhile crowds of scowling and angry-looking armed men were collecting round us, and in the bush on either flank.

My Muhammadan interpreter whispered in my ear that matters were looking very serious, when the guide's brother, who had remained with me, volunteered to go back to the town, less than half a mile away, to ascertain the cause of the delay. He suggested that we should proceed on to another small village about a couple of miles off, and there await him. This I did, the crowds of savages closing in upon our front, flank, and rear. They were very hostile and quite ready to murder us, and we knew afterwards that they were only awaiting the orders of their chief.

For a time our lives were trembling in the balance, when an old woman called out something in a shrill voice from the village, and the tension seemed to break. The crisis for the time being had passed. After a great deal of talk amongst themselves, the headman called a native and ordered him to "show the white man the road." There was some temporary relief in this, but more trouble was ahead of us. The new guide only agreed to go as far as the next village, where, he

stated, their boundary ended. Here, the same thing happened. We were surrounded by hostile and savage people, and I was compelled again to talk to them, and at last succeeded in obtaining another temporary guide. For the remainder of the day we pushed on, travelling along winding narrow paths and over fallen trees and other obstacles. The roads, or rather tracks, were awful, the vegetation and foliage resisting, the environment depressing, and all the time we were being followed and threatened. I was, nevertheless, able to take and read the time and bearings, and note them down in the field-book.

By 6 p.m. we were within about a quarter of a mile from a place called Mumusa, when we were again stopped by more armed natives, who told us that there was "no road," and that we could not pass. The interpreter asked the way round, but he was told there was none. After a great deal of talk, a native volunteered to inquire of the headman whether we could pass, and after waiting for some twenty minutes we were allowed to enter the town. At this place I asked the chief to give shelter for the carriers, staff, and self, telling him that we were tired and hungry, and had journeyed many miles. He refused, and as the place was full of hostile-looking people, I decided to push on to the next large town, called Kwalahun, in the Taramba chiefdom of the upper Bande country.

It had by this time become nearly dark, and we were again met outside the town by crowds of men, who refused us admission. The noise they were making was deafening, and the place was rapidly filling, for some of our friends at the former villages had followed us, and joined in with the others. As we could again neither go on nor turn back, I decided to sleep, or rather rest, in the adjoining forest, trusting that no attack would be made upon us during the night. Just as the weary and frightened carriers were preparing to light a fire, a brother of the chief of the Taramba country turned up, and after a deal of talk offered to take us to a place on the top of a neighbouring hill, which consisted of one small hut and two sheds, and where, he informed us, we could spend the night. This offer I accepted, and weary, hungry, footsore, and absolutely worn out, we dragged our limbs to the proffered shelter, through the inky darkness, and along a narrow winding path, not knowing whether we were to be treacherously murdered at any moment. Here we remained for the night, but sleep was out of the question, because we had all to be on guard.

At 2 a.m. in the morning, a messenger arrived to say that the paramount chief of the Taramba country, who lived at another town, had sent orders to the people of Kwalahun to allow us to sleep in the town. This I refused to do, but told the messenger that I had decided to enter the place at dawn. It is advisable to show a bold front to these people on such occasions, even although one's battery consists of only three carbines and a pocket revolver. At about 6 a.m., therefore, we

entered the town, which was packed to overflowing with a hideous and wild-looking lot of armed savages. Into the middle of this crowd we went, the carriers sitting on their loads, and myself resting on a small stool in the midst of them, with the interpreter and servants standing behind. Many questions were asked by the speaker on behalf of the Chief as to our object in coming into the country, where we had come from, etc., etc. Any untoward incident, such as the firing of a gun, would have acted like a spark, and I was perfectly aware that our lives hung on my answers and upon the behaviour of the poor carriers, servants, and interpreter.

Most of the carriers behaved splendidly, and my Muhammadan interpreter was simply superb. Soon after I had finished talking to the natives, a very fortunate and rather extraordinary thing happened. A tall Muhammadan priest, clothed in white robes, walked right into the midst of the people and came up to me. He was an old friend whose acquaintance I had made some years before at Bariwala, on the frontier. Being ignorant as to how matters would go at the meeting, and not knowing whether we were to be killed or not, he had been afraid to show himself before, and had remained hidden in the town. As soon as he had greeted me and some of the other members of the caravan, he addressed the chief and people, stating that he had known me before, and adding by way of encouragement, that I was "a good white man for the black." He suggested that he should accompany us to the town of the paramount chief, which was a few hours away. This was finally agreed to, so we started off for the place, called Singbalahun, where we arrived at 12.15 p.m. Here the paramount chief of the Taramba country, an old white-haired man, with an evil though shrewd countenance, was waiting to receive us.

The place was as usual crammed with people, and it looked as if the whole male population from the neighbouring towns and surrounding country had come in to see us. I talked to the chief, explaining our mission through the interpreter. After a great deal of talk, he told me that the country was disturbed owing to the fighting with the French, and to the doings of the Liberian Government at and about Kanre Lahun, and in other parts. He said that it was for this reason, with others, that the people did not want to see any civilized person, black or white, in the country. He added that the white man and the "civilized" black man did no good when in contact with the people, and could not understand their ancient laws and customs. Also that after a time the people became demoralized and their women folk debased; that their "boys" and domestic slaves ran away, wore the white man's clothes, and returned to despise their fathers. Also that the black soldiers, dressed in Government uniform, plundered and terrorized the people whenever they could, and outraged their women.

After this remarkable speech, the old chief, who had spoken more

like a statesman in a civilized country than as a barbarian in savage Africa, ended by saying that he did not understand how we had managed to get here, and that he would go and consult the other chiefs and elders of the country, who had already arrived in the place. Meanwhile streams of fighting-men had crossed the Makona river to the north, and were arriving every minute. Large numbers of these people were Kisis, who had been giving the British Government a good deal of trouble on the Anglo-Liberian frontier. Their chief, Kafura, had sworn to cover his war-drum with the skin of a white man. So now, they probably thought, was a rare opportunity to get the parchment. A number of the chief's subjects and the Kisis demanded that the white man and his speakers (interpreters) should be killed, but that the carriers should be taken as slaves. After long arguments, much talk, and discussion, the old chief eventually had his way, by offering to pay, according to the law of the country, a large sum of money to the medicine men, in order to induce them to annul the powers of the fetish from an infraction of the oath, or, literally interpreted, to "pull the swear." The fetish doctors, who had charge of the "medicines" upon which the oaths had been taken, were recognized in having this power, for under certain conditions they could remove the effects of the oath by some supposed magic means and ceremony. The old chief was anxious, not for our lives (about which he probably cared little), but to avoid the responsibility and probable consequences, of having us killed within the borders of his own jurisdiction. At the end of the meeting, the chief suggested that we should remain in his town that day, adding that it would be necessary to send his messengers to the neighbouring chiefs to ask them to allow us to pass through the country unmolested. These chiefs had doubtless been a party to the oath also. I agreed, there being no other course open, to remain in the town for that night, and gave orders for the march of the caravan at dawn the next morning.

The chief put in an appearance about 6 a.m., and asked me to remain until the afternoon, adding that he wanted to send more messengers. The first lot had returned, but the answer they brought back did not appear to be satisfactory. Fearing treachery, I refused to remain; and after a lot of talk, and being greatly assisted by our Muhammadan friend the priest, the chief agreed to lend us his principal messenger as a guide. Calling this man, he handed to him his own sword, and ordered him to show us along a little frequented path, by following which the numerous and doubtless hostile towns along the route would be avoided. Consequently, on May 10 the little caravan started off once more, being still accompanied by the Muhammadan priest. We sped along through rough hilly country. There were, of course, no roads, only mere tracks, sometimes difficult to discern, while the giant foliage and huge creepers swinging overhead checked us as usual on

the way and distressed the carriers. We passed deserted villages. Big farms and cultivation, showing an industrious people and a populous territory, were frequently met with. The carriers required no urging on the way, for after their experience, and fearing a repetition of recent events, they sped fast and almost frantically along. Now and then a black and armed figure, as still and silent as a statue, would be seen gazing at the column from afar.

For hours the energy of pressing the pace, so far as the state of the paths would allow, neither slackened nor varied. At exactly 2.45 we crossed the tribal boundary into friendly country, and a great shout went up from the caravan, who realized that their troubles were over. Shortly after this we entered Massabalahun, in the lower Bande country, feeling and looking, after the recent experiences, a very worn-out and battered party. We had therefore got through this hostile and inhospitable country, practically unarmed and without mishap or bloodshed. Of course I had no idea, nor had the French officers on the frontier, that we were going to plunge into such a hornets' nest.

Little or nothing was known about that part of the hinterland. No European, the people declared, had ever passed through it before. The natives had never been conquered, and consequently knew little or nothing about the strength of the British and French Governments. During the whole of this tour I succeeded in taking the times and bearings of the route, and noted them down. Our lives were spared by great good fortune, due to a large extent to the faithful interpreter, the behaviour of the carriers, and to the kind offices of our Muhammadan friend, the priest.

The following day we reached Bandewuru, in the Tunkia chiefdom of the Kisi country. At 6 a.m. on May 16 we marched to Yandehun, in the Bombare country, which, although in Liberian territory, is at present policed by the British. The following morning we started off for Pendembu, in the Sierra Leone Protectorate. We crossed the frontier into British territory, and left behind us what might indeed be called "darkest Liberia," at precisely 10.50 a.m., entering Pandembu at precisely 2.25 p.m. on May 17, 1908. On May 18 we marched once more for Baiima, at the railhead, where we arrived worn out. That same afternoon I paid off the carriers and staff, giving the interpreters a good deal extra from myself in appreciation of their services.

Although this tour was a flying and very tiny one (almost infinitesimal in the world of travel), being hurriedly carried out between pressing work at Monrovia and the rainy season, some information was gathered about the geography and geology of that part of the interior, its inhabitants, and its potentialities. A large part of the Liberian hinterland consists of a populous territory, rich in indigenous products, and inhabited by numbers of vigorous, powerful, and warlike tribes, whose principal occupation, as before stated, consists in the selling,

buying, and capture of slaves. These unhappy creatures are, as a rule, seized during a raid, and become the property of the conquerors. The indigenes know and care little about the Americo-Liberians on the coast, and when they do come in contact with them, their presence is only tolerated by the chiefs because they give guns, powder, and liquor, and make no attempt to interfere with slavery.

It seems deplorable that the indigenous wealth of the country is being lost year by year owing to the prevailing conditions. Apart from the commercial aspect, the country is full of interest to those who would explore away from its seaboard with note-book, pencil, and camera. Much of the history of Liberia is necessarily bound up in her frontiers; for even in this little-known part of Africa they have played, and are playing, an important *rôle* in her history, even as frontiers play their part in the life and history of other and greater nations.

PROJECT OF A DANISH EXPEDITION TO THE CENTRAL ESKIMO.

By KNUD RASMUSSEN.

It is, I think, universally acknowledged that the study of the Eskimo is a natural task for Danish men of science. For more than two centuries Denmark has held the fate of the West Greenland Eskimo in her hands, and literary and scientific work done by Danish men has resulted in modifying the views held by the civilized world regarding the culture of the Eskimo. In recent years our knowledge of the areas inhabited by the Eskimo in present and past times has been steadily nearing its completion. We know that the Eskimo have lived nearly everywhere along the shores of Greenland, and we now are brought face to face with the problem—from where and along which routes did the Eskimo migrate into Greenland?

Geographical and ethnographical facts prove beyond a doubt that the Eskimo territory at Smith sound and Cape York must be looked upon as the first station along the marching line of the Eskimo on their migration into Greenland. Apart from this one point, however, we know very little, and numerous questions bearing a more or less direct relation to this point are still awaiting their further solution. Partly as a member of the first Greenland expedition of the late Mylius-Erichsen, partly travelling on my own accord, I have, since 1902, chiefly occupied myself with the study of the Cape York tribe, and among them, as well as among the other Greenlanders, I have collected a very considerable ethnological and ethnographical material. In my travels, as well as during my stay among the Eskimo generally, I have profited largely by the fact that I myself was born and spent

my early years in North Greenland, so that I am fully familiar with Eskimo life, and the peculiar way of travelling in Eskimo countries. Through my mother I further descend from Eskimo ancestors, and I speak the Eskimo language as my native tongue, all of which circumstances have helped me, as though I were one of their own, to win the confidence of the Eskimo, thus enjoying an unusual opportunity of penetrating into their contemplative life, their religious ideas—in short, the whole of their intimate life and culture. In consideration of all this, I look upon it as a sort of vocation to try to find a solution of the above-mentioned problems as to the immigration of the Eskimo into Greenland in connection with the general study of the American Eskimo tribes.

Among the Greenland Polar-Eskimo at Smith sound I have been so lucky as to meet a number of families who must be looked upon as being the last immigrants from the American Eskimo districts, and though through conversation with these immigrants I have not been able to establish where exactly they had their native country, among other things because the men who made and directed the voyage are dead, while those who are now alive only took part in it as small children, I look upon it as all but settled that the country from where they immigrated must be sought about the north-western interior of Baffin's Land; that is to say, in the sea inside Bylot island, as well as along the Fury and Hecla straits, in which two territories the population along inland routes which are till now unknown to us seem to have been in close communication with one another.

These inhabitants of the north-western Baffin's Land are, however, very little known, and, at any rate, have never been subjected to a thorough ethnographical study. The Baffinlanders, found and studied by Frans Boas in the Cumberland sound towards the south-east, live so far from the inhabitants of the north-western Baffin's Land, and under such widely different conditions of life that it is impossible to make any comparison between those two groups. Upon the whole, the Eskimo in the north-western Baffin's Land are among the most unknown of the Eskimo people, though this district must naturally be looked upon as the very thoroughfare from the American continent to Greenland.

It is further known that the Eskimo at the Fury and the Hecla straits are closely connected with and related to the Eskimo inhabiting the southern part of the Melville peninsula, or the districts round Lyon inlet, Repulse bay, and Wager river. These Eskimo are likewise very little known, and have never been properly studied.

Still scantier is our knowledge of the group of Eskimo who now and then visit the shores of Hudson bay, near Chesterfield inlet, but whose chief territory is the inland and the lake groups in the tundra-land (barren grounds) between Hudson bay and Coronation gulf. In

opposition to almost every other Eskimo tribe these Eskimo, who are known by the name of the Kinipetu, are inland dwellers, and, if only for that reason, of the greatest interest.

Among the problems which seem most pressing as regards the latter tribe suffice it to mention their limits of extension in relation to their neighbours, the Tinne-Indians; further, the problem of the number of tribes among the inland Eskimo, as well as the districts of these tribes along each of the lake groups, and finally their means of livelihood during the two principal seasons, summer and winter. Above all, this latter question leads to the problem of the Eskimo culture itself, in that the theory has been set forth (H. P. Steensby, PH.D., 'The Origin of the Eskimo Culture.' Copenhagen, 1905) that the fishing methods used by the inland dwellers on the frozen lakes of Canada have been transformed by the Eskimo along the sea-shore, where they became the well-known methods of seal-hunting from the sea-ice (the Manpok methods, etc.). According to this supposition the Eskimo culture was to have its seat near the hemmed-in seas towards the Arctic archipelago, north of the ice-sea shore of the continent, or, in other words, the districts round Coronation gulf and further east, near King William's Land and the Boothia spit.

The last-mentioned districts were last visited by the Norwegian Gjöa expedition, which from there brought back very valuable ethnographical collections, though it had not been able to carry on a thorough ethnographical study. Even less than their kinsmen at the Boothia spit had the inhabitants of Coronation gulf been brought into contact with Europeans, and consequently they are still more unknown. It may be remarked that their technical culture offers the peculiarity that they make their weapons and utensils out of solid copper from the surrounding districts.

If the above-mentioned theory about the culture of the Eskimo should prove to hold good, we have, perhaps, here in Coronation gulf, one of the points of departure of the immigration of the Eskimo who at last reached the Danish possession, Greenland. And therefore, as for many other reasons, the tribes at Coronation gulf must be included in the researches, the starting-point of which was the problem of the origin and the routes of the immigration of the Greenland Eskimo.

It is to be observed that I intend to carry on my researches on as wide a basis as possible, and study, not only the way in which the various districts obtain their means of livelihood, their technique and utensils, but also, as thoroughly as possible, to collect legends and old social and religious traditions. I have already done a good deal of work in the last-mentioned direction, some of the results of which have been laid down in my book, 'The People of the Polar North' (Kegan Paul, London, 1908). Besides, I have a very extensive collection of material from the whole of Greenland, which material can

only be used to the full, and attain its real value, when supplemented with material for comparison from the American Eskimo tribes.

As a practical solution of the problem, I propose the following :—

The expedition, the official name of which will be "The Danish Ethnographical Expedition to the Central Eskimo," will start from Copenhagen on its own ship in the summer of 1911. The type of ship which I propose to use is the *Göa* type (with a motor), seeing that it has been used with such great success in these very districts. On its way out the expedition will call at Danish West Greenland for sledge-dogs and fur-clothes, which, as far as possible, must be ordered beforehand. From there it will go through the Hudson strait, and after that, by way of the Fox basin, it will try to reach a good winter harbour in the Fury and Hecla straits. With these headquarters as a starting-point, it will be convenient to carry on the above-mentioned studies and sledge-trips in and round north-western Baffin's Land.

In the following summer the expedition will start south, and look out for new winter quarters in the neighbourhood of Chesterfield inlet; only it is very probable that I myself will prefer to make this voyage by sledging along the coast. From these southern winter quarters the expedition will study the inland Eskimo on Barren Grounds, while the ethnographical material, collected and bought from the natives, will be brought on board the ship.

In the following spring part of the crew will lay a depôt, partly consisting of provisions, partly of things for bartering with the Eskimo in Chesterfield inlet, as far as possible towards bottom of the latter, eventually as far as the western side of Baker lake. After this work has been done, the ship will start for a new winter-harbour in the neighbourhood of Repulse bay, at the southern end of the Melville peninsula, while I myself, with the assistance of a couple of Eskimo, possibly using canoes of birch-bark, will bring the depôt as far north towards Coronation gulf as the natural conditions permit.

This work, however, must not prevent me from keeping in constant touch with the Eskimo, so that I can study their inland wanderings, their doings during the summer hunting, and, if possible, make archæological researches. As soon as the lakes and rivers are frozen over, and the snow covers the ground so as to make sledging possible, the expedition will continue the voyage and the freighting of the objects acquired through bartering towards Coronation gulf. Among the Eskimo of that neighbourhood I shall remain until April next year, when I intend to make the last sledge trip along the coast of the continent, visiting the Eskimo tribes which live there.

In the course of the winter the crew will have laid a depôt of provisions for me, in a place agreed upon beforehand, somewhere near the Boothias pit. In June I have to be back in the ship, and with the first breaking up of the ice the expedition will start directly for Copenhagen.

From the above it will appear that the extensive sledge-trips, and the collections which will, it is hoped, be the results of these sledge-trips, must necessarily pre-suppose a ship as the headquarters of the expedition. To manœuvre the boat we must, I think, have a captain, a mate, and three sailors.

Besides, the captain of the ship, together with the mate, must do the necessary cartographical work, which, especially in north-western Baffin's Land, will be very considerable; likewise, they must be able to make the meteorological observations.

Seeing that the route followed by the ship-expedition, also in other respects, will offer very interesting, hitherto unsolved scientific problems, the staff will further include a geologist and a physician who, together with the geologist, will be able to undertake the botanical and zoological studies if necessary, also to do the work of an anthropologist and archæologist. Chiefly as regards the study of glacial geology the districts round the projected winter harbours are of the greatest interest, and offer the possibility of making important comparison with the natural conditions found in Greenland. In northern Baffin's Land the glacial formations, the extension and nature of which are hitherto unknown, as well as the Quartiary formations in connection with the glacier, will offer an instructive transitionary stage between the totally ice-covered district of Greenland and the Barren Ground, now free from ice, but in former days covered with glaciers. In Baffin's Land and the Melville peninsula there is also the prospect of carrying on important palæontologic studies, while the Barren Grounds to the west of Hudson bay, which, geologically, are hitherto known through a few hasty visits from Canadian geologists, are furthermore of the special interest that the great American glacial period probably originated in these districts, for which reason researches carried on here offer the possibility for solving a series of problems as to the motion of the ice.

From a geographical point of view, the regions in question are, generally speaking, so unknown that every increase of our knowledge will be of the greatest value, and the expedition therefore ought to profit by the opportunity of making studies and collections in various directions, provided that this work does not throw obstacles in the way of the chief purpose of the expedition—the ethnographical researches.

NOTES ON DETERMINATION OF POSITION NEAR THE POLES.*

By ARTHUR R. HINKS, Royal Geographical Society Lecturer in Surveying and Cartography, Cambridge University.

THE writer is fully conscious of the fact that in the severe conditions of polar travel it is not a question of what observations might with advantage be made, but of what can actually be done. The only purpose of these notes can be to

* Research Department, November 18, 1910.

provide a few pegs upon which those who have experience of polar observation are invited to hang the results of their experience.

Published accounts of the details of polar observation are scanty. By far the most complete is Prof. Geelmuyden's discussion of the astronomical results of Nansen's expedition ('Scientific Results,' vol. 2). But these refer, in great part, to a special case—the winter drift of the *Fram*. Star navigation of winter quarters is altogether exceptional. We will confine ourselves for the present to the case of sledging equipment and sights to the Sun only.

The points for discussion may be grouped under three heads—

(1) The instrumental equipment and methods.

(2) The chronometers or watches.

(3) The reduction of the observations.

(1) The principal question is, Theodolite or Sextant? Recent experience seems all in favour of the small "mountain" theodolite, as used by Captain Scott and Sir Ernest Shackleton. Its obvious advantage is that by observing on both faces the errors of adjustment are self-eliminated. A recent traveller observed only on one face. But if, owing to severity of cold or want of time, the double observation is awkward, observations on alternate days should be made on alternate faces. The stand for the theodolite is of importance. Nansen used a brass plate bedded on snow, and lay down. But this must be uncomfortable, and it will be interesting to hear the experience of Antarctic observers. No account of the *Discovery*'s theodolite has been published. What was it made of? Nansen found aluminium very unsatisfactory.

The sextant and artificial horizon together weigh little less than the theodolite. The sextant was found by Nansen to be unreliable in extreme cold; very probably it developed error of eccentricity, which is very difficult to determine. And observation of a low sun with an artificial horizon is always difficult. Mercury horizons are liable to freeze; glass horizons do not seem to give satisfactory results. Occasionally it is possible to use a pool of water on the ice; but this must be rare. Some observers have used the natural ice horizon; but this must be very rough and uncertain owing to the piling of the ice; and further, there is a difficulty about the "dip" and the raising of the apparent horizon by abnormal refraction. Geelmuyden gives some interesting results which show that in extreme cold the visible horizon is sometimes elevated by twice the amount that it should be depressed.

Considering all these difficulties, we may conclude that the theodolite is much better than the sextant for taking altitudes. And it is immensely superior in the observation of azimuth. The verdict must therefore be for the theodolite.

It must be important to cover the metal of the instruments as much as possible to protect the hands and face from contact. It would be interesting to learn the details of methods which have been found successful.

(2) On board the *Fram* the chronometer Hohwü 639 maintained an excellent rate, and the uncertainty of G.M.T. probably never exceeded $\pm$ 20^s, though G.M.T. in summer could be checked only by solar eclipses, of which two were observed during the drift. It would be interesting to have full information about the rates of the chronometers on the *Discovery* during her stay in the ice. Chronometers landed for use in observation huts undergo much severer conditions, and Drygalski found it impossible to keep his chronometer going in the pendulum hut.

The travelling rates of watches differ, of course, considerably from their stationary rates; on the *Fram* sledge expedition, the mean rate of two watches differed 12^s per day from the rate on board. The slight information given by Lieut. Mulock (National Antarctic Expedition, 1901–1904, Charts) suggests that the watches on the *Discovery* sledge journeys ran better, but details are wanting.

(3) The correction for refraction is important and difficult. Geelmuyden used Albrecht's tables, founded on Bessel's and extended to −50° C. by his formula. He gives observations of very low altitudes made expressly to determine refraction, but does not discuss them. Mulock used Bessel's tables, but gives no details of his extension of the tables for low temperatures.

Very little information is available as to the accuracy of the sights obtainable under Arctic conditions. The writer would urge that it is important that full details of all the observations made on recent expeditions should be published, in order to provide material for the discussion of their accuracy. Astronomers have an invariable rule, to publish their observations in such detail that it may be possible to assign limits of probable error to the results. The same rule might very well be observed in the publication of the results of polar expeditions. This remark need not be taken to imply an expectation of impossible refinement in observations made under rough conditions. But at present it is difficult to say whether the probable error of a "fix" with the mountain theodolite on a sledge expedition is one mile or two or five. And this might be remedied at once by full publication of the observations.

Near the poles the ordinary methods of determining position fail to some extent. Local time and longitude tend to become indeterminate, and this gives the impression that there are great uncertainties in the "fix." To a considerable extent this difficulty is artificial, and by a suitable modification of the methods of reduction employed may be avoided. The writer suggests that a modified Sumner method will give a rapid and easy graphical method of discussing polar observations. [A brief account of the method is appended. It is being developed, and a fuller account will be published later.] The method is suggested, in the first instance, as a convenient way of examining a long series of records. But it is possible that it may be of use on an actual expedition.

Incidentally the method shows very clearly that the accuracy of the "fix" depends entirely upon the accuracy of the "sight" and the accuracy of the G.M.T. carried by the watches. So long as pairs of observations can be secured on considerably different true bearings of the sun, it is comparatively unimportant at what time of day the observations are made; there is no real necessity to interrupt the journey at local noon; and the apparent difficulties connected with local time and longitude disappear.

Graphical Method of Reducing Polar Observations.

Take a polar chart, with parallels numbered in degrees of polar distance, and meridians numbered in hours from Greenwich.

Suppose two sights—

A at G.M.T.	$14^h\ 29^m$	alt. of sun	18° 20′	decl.	13° 46′
B	„ $20^h\ 47^m$	„	14° 12′	„	13° 50′

Reduce to G.A.T. and lay off meridians in the corresponding azimuths.

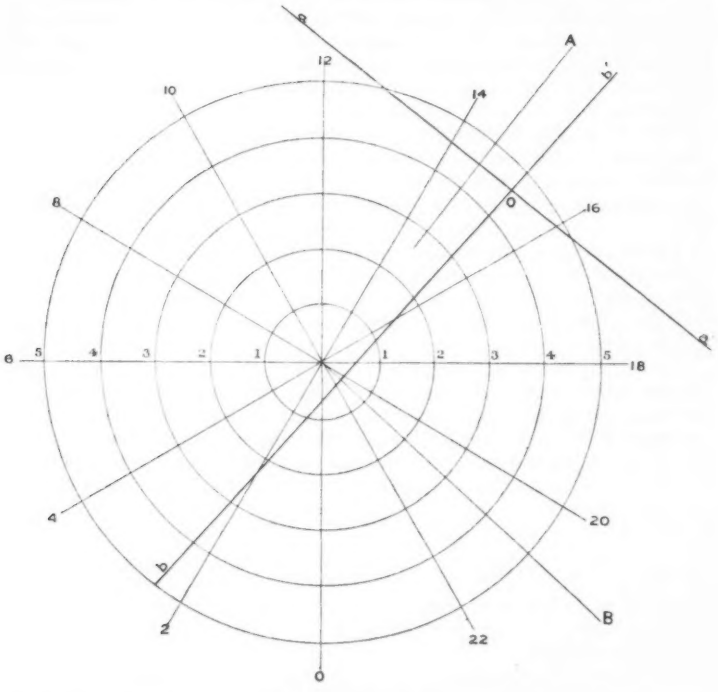
At first observation Sun is on meridian A. The circle of equal altitude 18° 20′ cuts this meridian at polar distance = altitude − declination = 4° 34′. The line aa' at right angles is an approximation to the circle of equal altitude, and the observer must be near it.

Similarly construct the perpendicular bb' to meridian B, cutting it at polar distance (14° 12′ − 13° 50′) = 0° 22′. The observer must also be near this line. Hence his position must be near the intersection O. The method is evidently a modification of Sumner's.

The circles of equal altitude are necessarily very large, as the Sun is always low. They lie on the Sun side of the approximate Sumner lines drawn. In the present case the circles would evidently intersect outside O, close to the line aa' and a little removed from bb' towards a'. Within 5° of the Pole the correction for curvature of the Sumner lines does not exceed about 3′. Hence the method gives a rapid way of checking a whole series of observations made on any bearings. Perhaps it is well known. The writer has not come across it.

Incidentally it shows that two sights on well separated bearings give as good a fix close to the Pole as anywhere else. The apparent trouble about the indefinite-

QUICK METHOD OF DETERMINING APPROXIMATE POSITIONS.



ness of local time and longitude is artificial, due to use of unsuitable co-ordinates. A little extra trouble will make the method sufficiently accurate for all purposes. Use a polar stereographic projection, which is practically the same as the polar equidistant close to the Pole. Then the circle of equal altitude becomes a circle on the projection. It is easy to calculate its radius on the projection, and hence its divergence from the tangent at any distance from the point of contact. It would then be easy to make the fix graphically within 1′.

Small tables to give the curvature correction are under construction.

The method has all the advantages of Sumner's or Johnson's. Sights may be made at convenient opportunities, not necessarily at local noon. The only table

required is that of the Sun's declination. Within 5° of the Pole the sights may be worked up graphically in a couple of minutes with all required precision. The method is suggested, in the first instance, as a convenient way of examining a long series of records. But it is possible that it may be of use on an actual expedition.

Dr. STRAHAN (before the paper): The paper for this afternoon is on the Methods of taking Observations in the Polar Regions, by Mr. Arthur Hinks. It is unnecessary for me, in view of recent events, to enlarge upon the importance of an observer being able to ascertain his position when he is approaching the Pole. The difficulties of doing it are sufficiently obvious to any one who has glanced at the summary of Mr. Hinks' paper.

Dr. STRAHAN (after the paper): We have among us several distinguished cartographers from different parts of the world. We should be very pleased to hear any remarks on the subject from them.

The following letter was read from Admiral Sir ALBERT H. MARKHAM: Speaking from my own experience while sledging northwards over what we called the Palæocrystic sea, I am inclined to say that when a high latitude has been reached by a traveller, whose object is the attainment of a still higher latitude, no matter in which hemisphere, there are only two observations to be taken that are of any real importance in order to enable him to determine his position. These are for latitude, and those for ascertaining the variation of the compass. The latter is of great importance, for it enables the traveller to steer a straight and direct course towards the Pole. Observations for longitude are therefore unimportant supposing, of course, that your departure has been made from a base, whose latitude and longitude have both been ascertained before leaving. When I was sledging north, I never bothered my head about taking any observations for determining my longitude, but I was very careful to check my course by constant observations for the variation of the compass, thus enabling me to shape my course along the same meridian of longitude.

The only other observations that I took were those for latitude, and these were obtained by observing daily the meridian altitude of the sun, either at noon or midnight, whichever was the most convenient, and, of course, when weather conditions permitted me to do so. The taking of these apparently simple observations was not quite so easy as might be imagined. Even at the latitude that I reached, which was just beyond the 83rd parallel, I found it an extremely difficult matter, with a mercurial artificial horizon (constructed specially for use in high latitudes), to obtain reliable observations when the altitude of the sun was very low—as it was at midnight—for it was not an easy matter to bring the two suns, the true sun and the reflected one, into the artificial horizon, so as to obtain a proper contact with the lower and upper limbs. Then it must not be forgotten that the difficulties which were experienced by me in the neighbourhood of the 83rd parallel, and during the months of May and June, would be very materially augmented in a higher latitude, and would be doubly intensified at an earlier period of the year, say in April!

I am of opinion that during that particular month, it would be almost impossible, in a high latitude, to obtain the meridian altitude of the sun with the ordinary mercurial artificial horizon, even if the mercury was in an unfrozen state, and I know of no other practicable horizon that could be used so as to obtain an accurate observation.

I have no faith in a glass horizon; the difficulty of adjusting it, so as to make it perfectly horizontal by means of spirit-levels and thumbscrews in a temperature 30° or 40° below zero, would be enormous, especially when placed on

snow or ice. Oil or water horizons would be useless in low temperatures. I know nothing more aggravating than taking the meridian altitude of the sun in a high latitude; for its actual passage of the meridian is practically inappreciable, and it is most difficult to determine when the sun has actually ceased to rise and has commenced to dip! It is almost impossible for an observer to decide for at least thirty or forty minutes when the sun has passed the meridian!

I have had no practical experience of the use of a theodolite, but I am inclined to think it would be a better and more useful instrument than a sextant. No observations taken with an "ice horizon" would, in my opinion, be of any value.

Until recently I have never heard of chronometers forming part of a sledge equipment. In the first place, they would never stand the extreme cold to which they would be exposed, nor would they be improved by the rough usage which they would be subjected to on a sledge. I certainly would put no trust to their rate after being on a sledge for a few hours! In the expedition of Captain Nares, each officer in charge of a sledge was supplied with a chronometer watch, which he wore in a little pocket on the vest next to his skin, but nearly all these watches stopped, in consequence of the slight amount of oil, by which the works were lubricated, freezing. Finally, I should say that the more simple and the fewer observations, compatible with determining your position, the better. I have no reliance in positions determined by dead reckoning alone. I know on occasions when I was unable, from thick weather or snowstorms, to obtain observations of the sun for perhaps four or five consecutive days, I had to estimate the distance I travelled by various methods, and I always endeavoured to underestimate the distance, so that I should not be greatly disappointed when I was enabled to fix my position. I may say I was *always* disappointed, for I invariably found I had overestimated the distance travelled.

Sir LEWIS BEAUMONT: I have no doubt we shall hear later the practical experience of officers who have taken part in recent expeditions. I can only speak of the one which has been described by Admiral Markham, but there are one or two points in connection with it which I think it is worth while remembering. The expedition of 1875 was the last offspring of the great Franklin Search. It was fitted out by the officers, who themselves had taken part in that search, in the way which they looked upon as the very best. As you may remember, it was based on man-hauled sledges only, which has never been done since. That shows that it is hardly worth while going back to the expedition of 1875 for the purposes of making comparisons with later ones, but several points have been mentioned by the lecturer upon which I can give a little information. For instance, our expedition only used sextants, and the reason was that in the outfit everything was cut down to the very narrowest margin of weight, so that a heavier instrument, such as a theodolite, was rejected for the sextant. All exposed parts of the metal were covered with chamois leather, so that the inconvenience of touching them with your bare hand or face was removed. It must be remembered that in the expedition I am speaking of, it was not considered possible to travel in the winter, consequently the sun was higher during the long sledge journeys, and there was not the same difficulty in obtaining sights which winter travelling involves. There was no difficulty about the mercurial horizon either as to extreme cold or low altitudes.

We may look upon it that expeditions to the North Pole are practically finished. Commander Peary has been there, as the American Geographical Society has certified, and it is not likely that anybody else will ever again attempt it; there is Amundsen's expedition, it is true, but that is not for the purpose of reaching any definite point, and they will have no difficulty in fixing their position. There remains the South Pole; it will be very interesting to hear what the experience in the Antarctic is.

If the object is to reach the Pole, we believe now, from Sir Ernest Shackleton's discoveries, that it will be by a continuation of land travelling, and not over moving ice. The travelling, therefore, will be in spring or summer, and so free from some of the difficulties due to low altitudes.

Captain Scott: I wish to say that I heartily agree with the lecturer in considering that such a discussion as this may serve a useful purpose in defining the nature of the evidence which a scientific society such as the R.G.S. considers necessary that a polar explorer should produce to substantiate his discoveries. I regret that I had not sufficient notice of it to communicate with Lieut. Mulock, who had charge of our *Discovery* records; but I should have required a long notice to do so, as Lieut. Mulock is now in China. Speaking generally of the *Discovery* observations, it is to be recalled that observations for position were usually accompanied by bearings of conspicuous landmarks, and in a long series these would naturally form a check on one another. Any considerable error in position would be shown up by the impossibility of fitting in the land bearings taken at the same spot.

In regard to instruments, I am confident that the 3-inch theodolite, such as we used, is in every way more serviceable for polar work than the sextant. The natural horizon both in the north and south is hopelessly erratic from a variety of causes, and the artificial horizon is a clumsy and unstable instrument quite inadequate for the observation of low altitudes. A duplicate of the 3-inch travelling theodolite which we used can no doubt be seen at any time in Carey's shop, in Pall Mall. It is a very handy little instrument, but has certain drawbacks, to which I may briefly refer. I found the tripod unsatisfactory on the Barrier surface, as the legs had to be driven 8 or 9 inches into the snow before any degree of rigidity could be achieved; in some places even this did not suffice, and to get observations I was obliged to wait some hours to allow the tripod to freeze in and thus fix itself. I think this difficulty can be surmounted, and I propose to have flat plates attached to the base of the tripod legs in my future instruments.

Another difficulty arose on account of the contraction of the spirit in the levels; the bubbles became so enlarged in consequence that their limits could not easily be brought within view together. I think it advisable in the future to start with the smallest possible bubble or some device for compensating the contraction of the spirit. Our small theodolite could only be levelled roughly by the base-levels. To obtain accurate levelling it was necessary to adjust by the telescope level, by turning it over two screws or the third in the usual manner. With such small instruments, liable to occasional shocks, it is most important to take observations on "both faces." I will not say I always did so, but if I omitted to do so one day, I was most careful to take the fuller observations the next. A round of angles after chronometer sights was often a tedious and cold business, and I must confess that I often missed the final check which is customary after such a round, that of taking a second bearing of the sun.

With regard to refraction, we were, of course, greatly puzzled as to what tables to use. I am inclined to think the refraction small on the Great Barrier. I may mention that I frequently took meridian altitudes within a few miles, at noon and at midnight, and the difference in position given was never more than 3 or 4 miles. This gave the difference in refraction between a very low sun, 10° or so, and one at a considerable altitude, about 30°. I think it is arguable that if the difference in refraction at these altitudes is so small, the total refraction for either altitude cannot be very great. It is interesting to consider that in very high latitudes a sight at midnight and noon would practically eliminate refraction, and you have thus means of escaping all criticism of observations in this respect. At the pole refraction would not count at all if observations were taken on several bearings.

The lecturer has said that the watches supplied to the *Discovery* Expedition appeared to have been satisfactory. I regret that I cannot endorse that view; the only really good watch we had was that which I am now wearing—the rest were anything but reliable. But it must be remembered that it is asking a great deal of a watch, to expect it to keep an accurate rate under the circumstances under discussion. It is bound to receive occasional shocks; it is in continuous and irregular motion, and subject to considerable differences of temperature. It is remarkable that watches can be made to retain any degree of accuracy under such conditions. It is for this reason that I should deprecate placing too much reliance on any form of Sumner method such as that suggested by the lecturer. I remain a firm believer in the meridian sight, for latitude is, after all, the most important point for the polar explorer to determine. As a purely practical consideration, I might add, also, that the difficulties of handling a chart and fixing positions by drawing lines upon it are greater than those presented by notebook calculations. One can do a lot of calculation in a polar tent with notebook, tables, and pencil, when to spread out a chart and use rulers on it might be most difficult.

I do not think I have anything more to add, except perhaps to point out the ease with which the discoverer of the South Pole should be able to fix his position. Unharassed by the consideration of breaking sea-ice, he would aim at reaching his goal in the middle of the southern summer, when the sun has achieved its maximum altitude. The ideal day would be December 23. The change of declination would then be negligible in twenty-four hours—that is, the sun would revolve about the observer at a constant altitude. One can imagine, as a rough check, tracing the shadow of a vertical stick and finding a complete circle. May I add that I think the lecturer's suggestion that records of positions should be treated like other scientific data and published is a good one.

Sir DAVID GILL: I do not know, from the rather slighting way in which the polar traveller seems to speak of astronomical observations and their importance, that the astronomer very well comes in. I think that the suggestion of Mr. Hinks about the employment of the Sumner method is instructive. The Sumner method is really *the* practical method, for, at the instant of observation, it shows that the traveller must be somewhere on a particular circle on the Earth, and that is all that any single altitude can tell. A similar observation at another instant of time gives another circle on which the observer must be, and the insection of these circles is the traveller's position. Lord Kelvin some years ago gave a simple means for working out Sumner observations. I do not see that the whole of the observations need be completely worked out at the time. The astronomer, when he goes on an expedition, is only careful to collect the observations, and when he gets home he reduces them in the best way he can, and I think that what Mr. Hinks says is right, viz. that if we had access afterwards to those observations, they could be thoroughly discussed so as to give us some idea of the experience of the observers, and what accuracy is obtainable in such circumstances; and, at all events, it would put an end to all questions as to whether a man was or was not there. If we had these observations made in that way, simply a record that we had an altitude at such and such a chronometer time, you have perfect control, and I defy anybody to cook a series of such altitudes as the traveller went along.

Admiral FIELD: I am under the disadvantage of having had no practical experience of observations in the polar regions, but I can, nevertheless, realize the difficulties under which the observations are made. Perhaps it does not do to be too critical of the results which may be obtained from them. It would

be very desirable, no doubt, to have the original observations and to investigate them. I dare say the difficulties of fitting things in would rather surprise some of us. One knows quite well that it is not easy, even under most favourable conditions, to get three bearings to cut into a point when taken from three astronomical observation spots. I have never yet been able to do it satisfactorily, and that it must be still more difficult up in the Arctic regions I can fully realize. I think the lecturer referred to the necessity of taking observations on both faces of the theodolite. With a theodolite of ordinary pattern it is perhaps putting rather a heavy and unnecessary burden on the observer. His principal source of error lies, of course, in his level and collimation. These he can determine by separate methods, with less chance of disturbing the instrument. Frequently in our hydrographical work we do not observe on both faces, and I do not see, if it is good enough for hydrographical work, why it should not be good enough for polar work, provided the proper precautions are taken. I think there is an exaggerated idea of the accuracy of the observations that can be made in these regions. As regards the sextant *versus* the theodolite, under ordinary circumstances I am a strong upholder of the sextant, but in polar regions I think there can be no doubt about it that, considering the difficulty of observing with an artificial horizon at low altitudes, the theodolite must be preferable, and apparently that coincides with the experience of other officers. As regards the chronometers, the more recent chronometers of the Admiralty are keyless with quick train, so that they are very much better than the old pattern beating 5 to 2 seconds, which I think were supplied to the '75 polar expedition, and possibly to the *Discovery* expedition. Our recent pocket chronometers, if treated properly, are just as good as a box chronometer; they keep excellent time, and, by being fitted with quick train, beating 9 to 2 seconds, they stand very much rougher treatment without altering their rates. There is one other remark as regards the method which the lecturer proposes. It seems to me to depend upon the assumption that circles of equal altitude cut circles of declination at right angles. Now, in the figure which appears in the paper, when you are at the pole, of course your circle of declination is a meridian, but that is not so if you are not at the pole, and therefore it seems to me that this method can only be true absolutely when at the pole. I see the lecturer proposes using it within five degrees of the pole, but it would have an error, it seems to me, varying with the latitude and the hour-angle of the heavenly body. I may be wrong, and I should like to know if that has been considered by the lecturer?

Mr. Hinks: I think that there can be no doubt that the circle of equal altitude approximates very nearly to a straight line.

Admiral Field: I am not referring to the fact that the circle of equal altitude approximates to a straight line, but whether it cuts the circle of declination at right angles. I cannot see that it does.

Mr. Hinks: It is not on your own meridian; it is the meridian on which the sun is.

Admiral Field: I may be wrong, but that is as it strikes me.

Colonel S. C. N. Grant: I should like to speak on one small point, and that is to explain an incident I have come across practically, about observing face right and left with a theodolite. I was once working in Africa with some foreign officers, and I found we were always differing by a fixed quantity in the results of the observations. One night I said I would like to see how they observed, and I found that one of the officers observed his north star face right, and the south star face left; east star face right, and west star face left. That is an error which perhaps people who do not thoroughly understand the subject might get

into. Trying to get right, this officer went more wrong than if he had observed on one face only. Can any gentleman tell us at what temperature the spirit used on spirit-levels will freeze, and at what temperature watch-oil will freeze?

Captain SCOTT: Watch-oil will freeze directly it is out.

Mr. REEVES: The spirit with which spirit-levels are usually filled freezes at −200·2°.

Colonel Sir T. H. HOLDICH: Nearly everything I proposed to ask the lecturer has been anticipated, but there is just one point to remark as regards the theodolite. I have not had an opportunity of observing under such Arctic conditions as Captain Scott, but I have taken a great many observations with the temperature below zero and in pretty deep snow. I do not see why Arctic or Antarctic explorers should limit themselves to so small an instrument as the 3-inch theodolite, although I admit that the main point is the vertical circle. I have myself always used a 6-inch theodolite with both horizontal and vertical circles, and with this I could observe a latitude to one second of arc; and I found great value in the additional size of the instrument when I had to watch what the levels were doing. I did not find that if the stand was fitted with shoes it sank appreciably; but I did find it an absolute necessity to observe on both faces. No observation would have been accepted as valuable that was not taken on both faces, because the double observation not only eliminates the zero error, but also the level error, which is more important. I also wish to know, at what temperatures do levels cease to act? I imagine that there is a point of low temperature when you cannot trust your levels. Under any circumstances, I am in favour of an equipment of one 6-inch and one 3-inch theodolite.

Captain H. H. P. DEASY: I should like to ask Sir David Gill if he considers it would be possible to observe planets in the daytime, with a 3-inch theodolite?

Sir DAVID GILL: You can easily get Venus; I question very much whether you would see the other planets so well, but Venus is of course always easy to see, if you know where to point at.

Mr. BERNACCHI: I have had a little experience in the Antarctic with instruments, and do not agree with the lecturer that the conditions are so arduous. Most of these observations are taken in the middle of summer; in the winter of course the difficulties are greater. I think the thodolite is perhaps the best instrument for polar work, provided you have an expert observer thoroughly competent to make all the necessary adjustments. At the same time a great deal of good work can be done with an ordinary sextant if properly adjusted. The glass horizon is utterly useless in the polar regions. I have great belief in the mercurial horizon. The sextant is seldom used at temperatures below −40°, and if you have a mercury horizon and use it in a round dish say 6 inches in diameter, I think you could do very good work indeed. With regard to the refraction tables, we very seldom had to employ them at low temperatures: in the few cases, I simply had to take ordinary refraction tables, and subsequently work out the formula on my return home. The lecturer referred to the chronometers and the important data that might be derived from the *Discovery's* chronometers. I do not think you would get very much information from those chronometers, as they were kept in the ward-room of the ship, where the temperature was practically uniform; but I had one chronometer employed for pendulum observations on shore. I think you will find, in the results of our physical observations, some interesting information with regard to the behaviour of that chronometer at low temperatures.

Mr. REEVES: For years past it has fallen to my lot to investigate and compute observations taken by travellers in all parts of the world, including the polar regions, and I suppose I have thus naturally become a sort of repository of the experience

of travellers generally as regards these matters. It is for this reason that I venture to make a few remarks on the subject before us. In the first place, it seems to me that, whether we attempt to plot the results of observations by the adaptation of Sumner's method as shown by Mr. Hinks, or by any other such arrangement, or whether we follow the more exact method of computation, the final result must depend upon the altitude; therefore the method of obtaining the most accurate altitude in the exceptional conditions of high latitudes becomes a question of the greatest importance. Since an explorer in these regions must travel by daylight, star observations are practically out of the question, and he is restricted to the sun. First, as regards latitude, the observation for which is doubtless the most important of any on polar expeditions, instead of a single-meridian altitude, it would be better to take the altitude of the sun both at its upper and lower culmination. By this means refraction will be very nearly eliminated, or, at any rate, it will only be a differential quantity for the two altitudes, and as the difference between the altitudes can only be a few degrees near the pole, this method of observation should certainly give a more accurate result than an altitude measured only one side of the zenith. It would further tend to eliminate instrumental or personal constant errors in the measurement of the altitude. With reference to instruments, there can be no question that, provided a firm foundation can be obtained for the stand, a theodolite is preferable to the sextant; but when this instrument is used, the altitude should be measured on both faces instead of one face only, and the level-readings should also be noted, as if this is disregarded, considerable error may at times be introduced. For this purpose the level should be on the vernier arm, and not on the telescope. However, the value of face-left or face-right readings only depends upon whether the instrument is in proper adjustment. When this is the case, and the readings have been found beforehand to be the same on both faces, an altitude taken on one face only should give a satisfactory result. Of course, a theodolite cannot be used except on land or firm ice; on moving ice there is nothing to be done but take altitudes with a sextant, with the best available horizon, either artificial or natural. But the latter is never likely to be very satisfactory. The best form of artificial horizon is doubtless the mercurial, when it can be used; but as mercury freezes at $-40°$, this may frequently be out of the question, unless it is warmed by some means or other, as I have known to have been done on more than one occasion. The silvered plate-glass artificial horizon is never so satisfactory as the mercurial, specially at low altitudes, but has the advantage of being light and portable. The best form of plate-glass artificial horizon is one in which the glass is blackened throughout, for if it is silvered or blackened only on the back, there may be a double reflection, which considerably distorts the image of the sun. The plate-glass artificial horizon has necessarily to be levelled by a spirit-level, and this must be most accurately performed. The levels should not be attached to the artificial horizon, but separate, so that in the process of levelling their ends can be reversed. Owing to vibration due to traffic, it is impossible to use the mercurial artificial horizon in the Society's observatory, so I have had considerable experience with the plate-glass pattern, and find that with care, when the altitude is not too low—say, 30° or over—it is possible to obtain the latitude from the meridian altitude of the sun to a greater degree of accuracy than is generally supposed. However, altitudes such as 6° and 11°, of which we have heard lately as having been observed for obtaining latitude in the north polar regions, cannot possibly give reliable results. Several attempts have been made to combine some form of artificial horizon with the sextant instead of having separate instruments, and the most recent of this kind is a pendulum arrangement designed by myself, and noticed in the *Geographical Journal* for December, 1908. By reversing the

reflecting mirror errors are to a great extent eliminated, and I see no reason why this arrangement should not answer well on polar expeditions, specially as it is suitable for taking low altitudes. Reference has been made by Mr. Hinks to altitudes of the sun, taken during a recent Antarctic expedition, on one face of the theodolite only. As before stated, the value of such observations depends entirely upon whether the instrument was in adjustment, and in the case of the observations taken by the Shackleton expedition on the southern journey, I find, after careful inquiry, that every care was taken to see that the adjustments were perfect. The observations for latitude during this journey were made with a 3-inch transit theodolite, reading to single minutes, similar in pattern to that taken by Captain Scott on his expedition, and the readings were checked by several members of the party before being written down. I have seen the original notebook containing the record of the observations, and, after re-computing all the latitudes, it is satisfactory to find that in no case did the results of my computations differ from those made by Dr. Marshall and verified by the other officers of the expedition by more than 1′, although I used the best refraction tables and applied all possible corrections. In the case of the furthest south latitude obtained, 87′ 22″, the result of my computation agreed with that previously obtained within 10″ of arc. In order to test what could be really done with a small 3-inch theodolite, I recently took a single-meridian altitude of the sun for latitude with a similar instrument, on one face only, without paying particular attention to adjustments, and obtained a result within 3′ of the correct latitude of the R.G.S. observatory. Taking all thecircumstances into consideration, I feel sure that the observations for latitude observed on Shackleton's furthest south journey can be relied on to within about 2′, plus or minus, of the result given on his charts. I can only speak for the Southern journey map, but the mapping of the magnetic pole expedition I have every reason to believe has been most carefully done by Mr. Douglas Mawson, who is, I understand, a trained Australian Government surveyor of considerable experience.

As regards Mr. Hinks's chart, it is of course, as he admits, only a modification of Sumner's lines. Very similar methods have been used for years past, but I consider the manner in which he has plotted the lines to be original and ingenious. With reference to what Mr. Hinks states about the difficulties of time and longitude observations in polar regions being artificial, although I fully understand what he means by this, I think it must be admitted that in another sense the difficulty is often very real indeed. His own charts depend for their plotting upon Greenwich Mean Time. It is almost impossible to carry chronometers showing Greenwich Mean Time with anything like accuracy over the rough sledge journeys of polar explorers. Chronometers are all well enough on board ship, but when it comes to overland journeys through rough country, it is practically impossible to carry time, whether you have box chronometers or half-chronometer watches, unless careful and constant observations are taken to rate them. In very high latitudes the altitude observations for time necessary to rate the chronometers must be extremely uncertain, so that it becomes practically impossible to rate chronometers by the ordinary method, and to attempt to do so by any other method is usually quite out of the question. In lat. 88° an error in altitude of 8′ of arc will make an error of about a quarter of an hour in the time with an hour-angle of about five hours. Apart from the question of longitude, this uncertainty in Greenwich Mean Time has a direct bearing on the latitude observations, since it affects the corrections for the declination of the sun, which of course is given in the Nautical Almanac for Greenwich time.

Dr. STRAHAN: I have seldom heard a more interesting discussion than we have

had on this paper. It only remains for me to ask Mr. Hinks to reply, at not too great length, to the large number of questions that have been raised.

Mr. HINKS, in the course of a reply on the whole discussion, said that the greater number of questions asked had been answered already for him far better than he could do himself. He was glad to recognize that the consensus of opinion was in favour of the theodolite as against the sextant, and that it was generally agreed that it was not unreasonable to insist upon observations being made on both faces, even if pressure of time demanded that the alternation should be only from day to day. The very interesting statement of Captain Scott increased his desire that the observations should be published in detail. Captain Scott had remarked that if you observe the lower as well as the upper culmination of the sun during the perpetual daylight, you nearly eliminate the refraction and get your latitude accurately. It is equally true that a discussion of these observations would throw much light upon the amount of the refraction.

Mr. Reeves had suggested, in opposition to his view, that the difficulties concerning time and longitude were by no means artificial, but very real indeed; and had argued that a graphical method depending upon knowledge of G.M.T. neglected the fact that G.M.T. is difficult to carry, and almost impossible to determine during the Arctic day. In reply to this the speaker desired to point out that the graphical method was in this respect on all fours with other methods; you must know your G.M.T. approximately or you are altogether lost, until you get to the actual pole. The disadvantage of the ordinary methods was that they exaggerated the uncertainties due to the vagueness of local time and longitude. The graphical method avoided any direct consideration of these necessarily vague quantities, and at the same time exhibited in the most plain manner the uncertainties which were due to the uncertainty of G.M.T.

Admiral A. A. CHASE PARR, a member of the Nares Expedition, 1875–76, sends the following :—

"Perhaps some of the experience gained in working the transit and alt-azimuth instruments during the winter of 1875–76 at the winter quarters of H.M.S. *Alert* may have a bearing on this subject. Also remarks on the behaviour of the pocket-chronometers and sextant during the sledge journeys.

"Two of the principal difficulties in using the transit and alt-azimuth were—(*a*) The formation of rime on the glasses of the telescopes; and (*b*) the levels being rendered sluggish by the cold.

"With regard to (*a*) the difficulty occurred mostly in the winter, and was greater with the transit, which was in a house, than with the alt-azimuth, which was in a snow hut without a roof. On more than one occasion observing had to be given up on this account. The observation of an eclipse of the sun which was being made from the top of a hill near the ship was interfered with from this cause, the temperature at the time being $-37°$ Fahr.

"As to (*b*), our levels were specially filled with the purest spirit and very small bubbles. This answered perfectly as far as the bubbles were concerned, for even in the coldest weather they were always a suitable size. Below $-40°$ Fahr., however, the spirit became so sluggish that the readings were not reliable. Good observations were obtained with a temperatue of $-39°$ Fahr., and others are recorded at $-43°$ Fahr., but there is some doubt as to the value of these.

"Before $-70°$ Fahr. was reached the spirit was of such a consistency that it was necessary to alter the level considerably before the bubble would move at all. Also the liquid had turned a brownish colour, which may possibly have been due to some impurity.

"No difficulty need be anticipated from handling instruments in cold weather.

As has been seen, they are useless from other causes when the temperature falls below − 40° Fahr., and experience shows that, in calm weather, it is quite possible to work an alt-azimuth for over an hour at that temperature with bare hands, uncovered as well as covered parts of metal being manipulated. At lower temperatures mitts would be worn, which would be sufficient protection in themselves. It might perhaps be advisable to put leather on the eye-piece, but elsewhere it cannot be considered absolutely necessary.

"The only instruments we took with us sledging were a sextant and prismatic compass. The latter worked well, with a variation of about 102°, while as to the former we had no reason to complain. We had no experience of a theodolite when sledging, but neither theodolite nor sextant would be of much value at temperatures below −40° Fahr. However, in the Arctic there is not much chance of the thermometer falling so low when the sun is high enough for observation, though in the Antarctic it may be different.

"With regard to errors induced in instruments by extreme cold, there was some difficulty in adjusting our alt-azimuth, partly owing to the cold and partly owing to the fact that the case it was in had suffered somewhat on the passage out. The result for the determination of latitude by observation of thirteen stars passing south and a similar number passing north was a difference between the two of 8″·5, which was quite good enough for our purposes.

"It is true that all the pocket-chronometers carried by sledging officers of the *Alert* stopped at some time or other, mostly for a short interval, and then went on again. To give a definite example of how two of them behaved. We left the ship on April 3, when one chronometer had a rate of 4·65 seconds daily losing, the other 7·75 seconds gaining. Soon after leaving a temperature of − 42° Fahr. was experienced. On May 6 the difference between the longitudes obtained by two observers using the same sextant, but different chronometers, was 51 seconds; on May 11 one of the chronometers stopped for about ten minutes without any apparent cause, and then went on again. On the same day the difference in the longitudes obtained by the two observers using the chronometer which had not stopped was 6 seconds, the altitude of the sun being about 17° and the latitude 83° 19′ N.

"The deck-watch was used for all observations with the transit and alt-azimuth, and on those occasions was fully exposed to the cold for perhaps two hours or more without its being much affected.

"During the summer, provided it is not required to observe altitudes less than 15°, and provided the distance from the magnetic pole is sufficient to admit of the compass working satisfactorily, a theodolite does not seem to be necessary.

"As in all probability the accuracy of the longitudes ascertained when sledging would depend upon the accuracy with which the longitude of the winter quarters had been determined, a word with regard to that may not be out of place. Owing to the causes which have been mentioned, and others which have not, it was not easy for a single observer to obtain good results from moon culminations, the greatest difference amongst eleven accepted observations being 54 seconds. With occultations, however, none of these difficulties existed, the only thing necessary being a clear sky. One observation was made at a temperature of −71° Fahr., and another during a gale of wind through a small slit in the housing, both with good results. The greatest difference among six accepted results was 11 seconds."

THE FORESTS OF BRITISH EAST AFRICA.*

A FIRST attempt at a systematic survey of the forests of British East Africa, by Mr. D. E. Hutchins, forms the subject of a Government publication (Cd. 4723, October, 1909). It is to be hoped that this is only a first step towards following the admirable example of systematic stocktaking of the natural resources set by Germany in its East African colony.

Clearly British East Africa is climatically not a forest land. Most of its surface is covered by savannas and various kinds of loose thorny scrubs, which rise from the coast to an elevation of 5500 feet. Most of this scrub is, in its present state, of very little use, even for fuel, and it is advised to try and stock it with the Cutch tree (*Acacia catechu*) and the mesquite (*Prosopis juliflora*) from similar climates.

What forests there are are of local occurrence, and conditioned either by the water contents of the soil or by the altitude. Due to natural irrigation are the two marginal belts along the Juba and Tana rivers, from 1 to 5 miles in width, and extremely unhealthy. Although they are not worthless, it is advised that they be cleared for agricultural purposes. Equally due to soil conditions are the mangrove swamps. Back of the latter, the feeble but rather broken relief which extends along the sea determines the existence of a narrow and scattered coastal belt of loose forests of a truly equatorial character, though comparatively poor. These lack good timber, and possess but little value. Teak, mahogany, and various kinds of rubber plants might be introduced with profit, but difficulties of access stand in the way.

To encounter important timber tracts, it is necessary to ascend the escarpments of the highlands and reach 5500 feet (Nairobi). It seems possible that a considerable portion of these highlands were once wooded, or, in other words, that a portion of what is now park-like savanna or scrub-forest may have been forest at one time. At present the main timber areas are found round the Kenia, on the broken Aberdare range, east of the Great Rift, in the Mau, and round the Victoria Nyanza. These forests are all of the tropical highland type, *i.e.* evergreen, broad-leaved rain-forests of the temperate form. Yet they vary greatly alike in density and composition, owing to the differences in rainfall and altitude, the drier portions being more scattered and poor, the wetter parts being densest. Broadly speaking, they fall into a lower zone from 5300 to 7000 feet above sea-level, and an upper zone from 7000 to 9300 feet. The Mau and Victoria, as well as the lower portions of the Kenia and Aberdare, would belong to the former zone. The wettest parts often consist of stands of tall bamboos some 60 feet high. In the main, the timber forests, though extremely variable, appear to be characterized by a low stock of timber per acre—the timber lacking in straightness and regularity of growth—and by a high percentage of unsound trees. In some forests not 10 per cent. of the cedar are sound. The natural reproduction is not strong, and may even fail. Great care has therefore to be exercised in lumbering. The timber of the lower reaches is varied and rather poor, but improves both in quality and uniformity with increasing elevation. The upper zone contains the largest timber and exclusively the conifers. It is topped by a belt of bamboos in some parts, and by a fringe of giant heath leading to elevated pastures and shrubs.

The outstanding economic species are: two yellow-woods, or Podocarpus, one cedar, or Juniper, the Ibean camphor (*Ocotea usambarensis*), and two wild Olive trees. On the average the stand would correspond to that of a fifth-class Scotch Pine forest. The timber is of fair quality. These forests are reported to correspond

* 'Report on the Forests of British East Africa.' By D. E. Hutchins. London: Wyman & Sons. 1909. With Map and 25 Photographs.

exactly to those which are found at sea-level along the southern coast of South Africa in the Knysna district, or to those of Natal (3000 feet) and Transvaal (4000 to 6000 feet).

Evidently there is room for the introduction of many valuable species from other countries with a similar climate, and a large portion of the book is taken up by a discussion of the possible species to be tried. The author is well inspired when he puts the "tierra templada" of Southern Mexico and Central America foremost as areas to draw upon. On the other hand, the omission of the Amazonian slopes of the Andes and of the Parana basin, as well as of the north island of New Zealand, is rather remarkable. On the whole the lists proposed are very mixed and require careful attention.

The great question at the present time is evidently the fuel-supply for the Uganda railway out of the railway forest belt. This supply is estimated to be able to last only for seven or eight years more. A new policy is therefore imperative, and the author appropriately advocates the wholesale planting of eucalypts and black wattle.

In Mr. Hutchins' opinion, the future development of the colony is intimately connected with the preservation of the highland timber area, not only as a source of timber, but also, and more seriously, as a source of water-supply. Indeed, these forests are absolutely needed as water-conservers. Already the natives, Masai and Kikuyus, have made dangerous inroads on the forests, both by cultivation and grass fires. There are also a few important concessions in process of exploitation. In the animal world there is threatened the disappearance of the elephant, which Mr. Hutchins rightly deems a very serious disaster.

The all-important geographical *rôle* of these forests, the necessity of sparing, and eventually helping, their low reproductive power, and of stocking them with valuable timber, and of staying the disappearance of the elephants, go to make the handling of the British East African forests eminently a Government concern which calls for immediate attention. It should be borne in mind that the forest area is computed at only 1·55 per cent. of the total area of the colony. The most serious consideration should therefore be granted to the protective measures recommended in the blue-book, and to the timely warning given therein.

M. H.

THE ANNUAL MEETING OF THE GEOGRAPHICAL ASSOCIATION.

Address by the President, DOUGLAS W. FRESHFIELD.

THE annual meeting of the Geographical Association was held on January 8 last in the London School of Economics. According to the Annual Report, 168 new members have been added to the roll during 1909, the total membership being now 884, including teachers in every grade, school inspectors, and others interested in Geographical Education, both at home and abroad. Various lectures, specially intended for the teachers, have been given during the year in connection with the Association. A series of lectures on Methods of Geographical Instruction, delivered by Mr. G. G. Chisholm, Prof. R. A. Gregory, or A. T. Simmons, Mr. T. Alford Smith and Dr. Herbertson have been published in one volume, obtainable from Messrs. G. Philip & Son, 32, Fleet Street, E.C. Price, to members, 1s.; to others, 1s. 3*d*. post free.

Mr. Douglas Freshfield, the President of the Association, delivered his Annual Address, of which the following is a summary.

He said that the foundation stone on which the position of the Association in reference to geographical education had been based was the recognition of their study by the two ancient universities of Oxford and Cambridge. In the Cambridge School of Geography there had in the last year been some change. The Geographical Reader had been, so to speak, cut into three sections and distributed between as many separate Schools. This might extend the influence of geography in academical studies. On the other hand, there was some danger that it might detract from its conception and treatment as an independent subject. At Oxford they had to record, not change, but steady progress. Dr. Herbertson continued to build on the foundations laid by Mr. Mackinder. He was now engaged in a very arduous and important task, the endeavour to raise the nucleus of a fund for the permanent endowment of the School and also for the provision, when possible, of a suitable building for it. There was a notable opportunity offered to any man of wealth interested in geography of associating his name with a building worthy of Oxford and of the importance of the study to citizens of the British Empire. In Canada or the United States such benefactors were frequently forthcoming, and he had some hope one might be found in this country.

Meantime £1000 had been promised in two donations of £500 towards the needs of the School, and he believed that Lord Curzon, the present Chancellor of the University, himself a distinguished geographer, might be disposed to allocate a substantial sum out of the fund now being raised for the general purposes of the University for the same object.

Taking a wider view of the position of geographical teaching throughout the country, they might congratulate themselves on a substantial advance. The Association was growing in numbers, in resources, and in activity. Many successful lectures had been given in London and under the auspices of local branches in the provinces. It was proposed to extend the lectures to towns where there were as yet no branches. At Oxford the students had had the advantage of field-lectures from Prof. Davis of Harvard, which had been much appreciated.

At Glasgow, Captain Lyons, F.R.S., had been appointed to a Lectureship in Geography. At Dublin he hoped there would soon be a professorship. At Cork and Belfast Professors of Geology and Geography had been appointed. It was a combination on which he always looked with some suspicion, particularly when geology came first. Geology was a most interesting and important science, but it was also, to use one of its own terms, a singularly "intrusive" subject. They did not want geography taught as a branch of geology and in geological terms. The language of the geologist was in many cases, at least to his taste, objectionable! At any rate, many of its terms were very doubtful English, and could not be understood without an intimate knowledge of the classics. Moreover, the theories of geologists were often hypotheses, which vary from decade to decade, as to the action of physical agents in the past, whereas geography, dealing in the main with things seen, bases its arguments on existing facts. The distinction is indicated in the very names of the two sciences. He did not intend, however, seriously to disparage geology. His remarks must be taken rather as a retort to the attitude sometimes assumed by its professors.

It had been suggested to him that there was room for the practical application of local geography in connection with the new Town Planning Act, and he was told that several of their branches were making an accurate study of the surroundings of their respective towns and neighbourhoods. He could not imagine any more practical effort. While, however, such practical applications were very interesting for grown-up people, they must not forget that they had to deal in the first place with the education of children.

It was sometimes alleged that the child's instruction should commence with the things round his home, and not attempt to deal too soon with things far off. He thought this view neglected to take into account the imagination of the child. Curiosity about strange and distant lands was a common feature of the childish mind, and the teacher's object should be to excite interest by all the means in his power. While encouraging accuracy of local observation in his pupils, and making them reason from the things about them, he must lead them on to a knowledge of the distant wonders of the world. They had great aids in this task in the excellent series of cheap photographic plates, "Geographical Pictures," brought out by Messrs. Black and by Messrs. Philip, in the slides procurable by members of the Association, and in such recent works as 'The World of To-day,' and others of the same nature, amongst which he might mention the *Geographical Journal*.

GEOGRAPHY AT OXFORD.

At the beginning of the present term Convocation unanimously passed a decree constituting Mr. Herbertson Professor of Geography as long as he holds the office of Reader in Geography. This form of recognition is necessary because there is at present no endowment for geography, and a permanent professorship cannot be founded until there is. The need for such an endowment is emphasized in the Report of the Committee of the School of Geography for 1909, which has just been issued. A fund has been opened, and Mr. Douglas W. Freshfield and Lord Brassey have each promised to subscribe £500 provided a reasonable sum can be obtained. It is also reported that £175 subscribed to the Chancellor's Oxford University Endowment Fund has been ear-marked for the School of Geography.

The Report points out the steady growth in the number of students giving most of their time to the study of geography. In the Michaelmas Term of 1909 there were 32 such students, 15 men and 17 women, taking the Diploma and Certificate Courses in view of the University or the Higher Civil Service Examinations: 20 to 30 students attend Lecture Courses only. In the present term of 1910 there are 73 students—46 men and 27 women. Of these one is carrying on research work, 19 (10 men and 9 women) are studying for the Diploma or the Higher Civil Service Examinations, and 17 (7 men and 10 women) are taking the Certificate Course—in all 37 (18 men and 19 women). The income from fees, excluding examination fees, has grown from less than £110 in 1905 to £360 in 1909. Expenses, however, have grown much more rapidly than fees.

Endowment of teaching is not the only need of the School. The increase in the numbers attending the School, the increase of staff, and the growth of the collections of books, maps, models, etc., involving the introduction of new cases, have made the present accommodation quite inadequate. Temporary rooms have been rented. This very unsatisfactory arrangement is in itself insufficient. The Professor has drawn up a memorandum on the accommodation required for the School, allowing for a reasonable growth; but to secure it a large sum would be required for buildings, in addition to the cost of a site. A Geographical Colonial Institute, such as the Professor proposes, would be a great addition to the teaching and research resources of the University. As a temporary solution it was suggested that if the whole of the Old Ashmolean Building could be handed over within the next year or two to the School of Geography, the University would be relieved of the capital charges of a new site and building for a number of years. The trustees of the Chancellor's Fund were approached, and they offered to grant £500 towards the furnishing of the Old Ashmolean Building in this case. Unfortunately the interests

of the New English Dictionary and of the Bodleian Library render it impossible to give the rest of this building to the School of Geography, and no other is available. The University is faced with the problem of raising the necessary funds for a large new building.

A statute passed during the year allows the Geography Diploma to be registered for two groups, and any of the Certificates for one group in the Final B.A. Pass Examination, with certain restrictions. This ought to be taken advantage of especially by undergraduates preparing for teaching or for colonial appointments. The secretary of the Appointments Committee constantly reports that men with a geographical training are wanted, and the Professor has to reply that all the students of the School have already received appointments.

Undergraduates taking the Diploma Course are advised to spread it over more than one year if possible. This, however, adds considerably to the work of the staff, and so does the addition of a number of graduates and undergraduates preparing for the higher Civil Service Examination, for whom it has been found necessary to plan a special course.

The committee hoped that Dr. C. R. Beazley, who has been appointed Professor of History in the University of Birmingham, would continue for another year to lecture in the History of Geography, but he has intimated that this is impossible. The committee have congratulated him on his appointment, and thanked him for the work he has done for the School since 1901.

Mr. G. G. Chisholm, M.A., D.SC., Lecturer in Geography in the University of Edinburgh, was appointed Examiner in place of Mr. H. Yule Oldham, M.A., Lecturer in Historical and Economic Geography in the University of Cambridge, whose term of office had expired.

In addition to the ordinary courses of lectures on different aspects of geography, systematic tutorial instruction is given to all diploma and certificate students, and there are practical classes, seminars, and frequent excursions. Last year the students who chose Surveying as a special subject spent five weeks in North Wales, carrying out a large-scale survey under the direction of Mr. MacKenzie.

During the past year the special lectures delivered in connection with the School of Geography have been of exceptional interest, and the committee have to thank the distinguished lecturers who so generously gave them. Three dealt with mountain regions. Mr. Douglas W. Freshfield lectured on the Passes of the Western Alps, and Dr. Sven Hedin on his recent Travels in Tibet, in the Hilary Term; and Dr. M. Aurel Stein on Geographical and Archæological Exploration in Central Asia and Western China, in connection with the Ashmolean Museum and the School of Geography, in the Easter Term. Two were on N. American problems: Mr. George Anson Aylesworth, a special lecturer of the Canadian Government, gave an account of the Climate and Resources of Canada, and Mr. F. B. Vrooman summarized the work done and proposed for the conservation of the national resources of the United States during President Roosevelt's administration. In the Michaelmas Term, Sir Ernest Shackleton addressed an audience of undergraduates and graduates, who filled the Sheldonian theatre, on his expedition towards the south pole; and Lord Brassey showed his interest in the School by giving an address on the British Markets in Tropical and Sub-Tropical Countries, which he prefaced with an appeal for the endowment of the School of Geography.

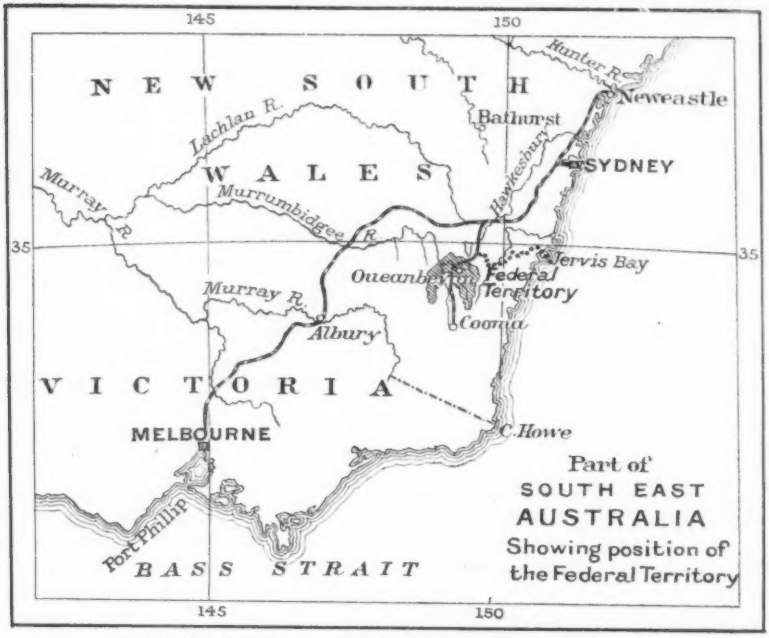
It has been decided to continue to ask, as part of the examination work in Regional Geography, for a geographical description of a district shown on any approved sheet of the 1-inch Ordnance map, based on personal observations in the district and accompanied by maps, sections, measurements, and statistical data. This has to be sent in at least a month before the written examination is held,

and so does not interfere with the final weeks of preparation for the rest of the examination. A number of these essays are of such quality that their authors have been asked to revise and extend them. It is hoped to publish a number of them in the course of the next year or two.

Over £1535 have now been spent on equipment, and many gifts have been received from our own and other governments as well as from private individuals. The school possesses 2809 books, atlases, and pamphlets, and 8852 maps. A bibliography of geography is being prepared, and about 14,000 cards are now ready. The collections of photographs and lantern-slides are very small, and contributions from Fellows of this Society would be welcomed.

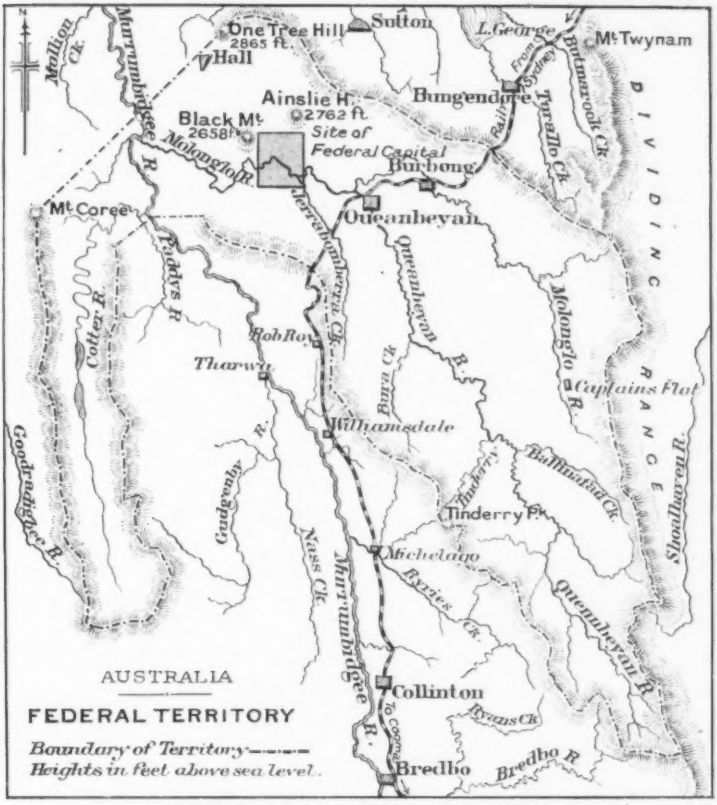
THE CAPITAL OF THE AUSTRALIAN COMMONWEALTH.

THE accompanying sketch-maps, based on a series of maps and plans accompanying a report issued by authority of the Legislative Assembly of New South Wales,



show the position and general features of the site finally chosen for the Federal Capital of Australia, as well as the limits of the larger Federal territory acquired by the Commonwealth for the use of the capital. The question, which had been under discussion some years without making much progress towards settlement,

was narrowed down within comparatively small limits by the passing of the Seat of Government Act, 1908, which provided that the site of the capital should be in the Yass-Canberra district of New South Wales; that the territory to be acquired should contain not less than 900 square miles; and that it should have access to a suitable port on the sea. Early last year a Board was formed for the purpose of considering the claims of the several possible sites within the district in question,



having regard both to their scenic advantages and to the facilities they offered in the way of water-supply, drainage, etc. After full examination of the area by an expert surveyor, and repeated inspections by the members of the Board, a series of recommendations was drawn up in June, 1909, leading, before the end of the year, to the passing, both by the Legislative Assembly of New South Wales and by the Australian Parliament, of a Bill for the transfer of the territory. The site selected for the actual capital is at Canberra, on the Molonglo tributary of the Murrumbidgee, just below its junction with the Queanbeyan. In the choice

SITE OF FEDERAL CAPITAL

Area of City ——·——·——·——

Contour lines with heights in feet above sea level ·····1850·····

Proposed artificial lake to level of ·····1825·····*contour*.

Roads ═══

Limit of timber ꝏꝏꝏꝏ

Natural Scale 1:50,000 or 1 inch = 789 Stat Miles

¼ ½ ¾ 0 Statute Miles

of the wider territory assigned for the use of the capital the principal consideration was water-supply, both for domestic purposes and also for the supply of power and for the creation of ornamental waters. This led to the inclusion of the whole catchment areas of the Cotter, Molonglo, and Queanbeyan rivers, somewhat exceeding 1000 square miles, as it was felt to be of the utmost importance that the whole area whence the supply might be obtained should be under Federal control. The present population within the territory is only about 4000. Of the rivers mentioned, the Cotter has the advantage of affording a supply of perennially clear and pure water, probably sufficient for domestic purposes, but for power it might be necessary to use the supply of the other two rivers. In order to regulate their flow and conserve a supply for ornamental purposes, the construction of weirs on their upper reaches is proposed. As a port for the capital, Jervis bay is considered to meet the requirements in a satisfactory manner, the most suitable area being situated at its southern extremity. A practicable route for a railway connecting it with the capital has been provisionally laid down.

REVIEWS.

EUROPE.

ICELAND.

'Isafold, Reisebilder aus Island.' Von Ina von Grumbkow. Berlin: Dietrich Reimer (Ernst Vohsen). 1909. Pp. 292. *Price* 6*m*.

'Wüstenritte und Vulkanbesteigungen auf Island.' Von Carl Küchler, M.PHIL. Altenburg, S.-A.: Stephan Geibel Verlag. 1909. *Price* 6*m*.

THESE books are popular descriptions of travel in Iceland, and describe much the same part of the island, especially the northern region: Akureyri, the Myvatn, the Odáahraun, and neighbourhood. Herr Küchler, who is the author of several works on Iceland, its people and literature, here aims at giving a simple description of incidents of travel, the country, and life in Iceland as they appear to the ordinary traveller, omitting all scientific matter. Fräulein von Grumbkow penetrated more deeply into the interior, the object of her journey being to inquire into the fate of her *fiancé*, Walther von Knebel, who was lost in 1907 on a lake in the Askja-cauldron. When Thoroddsen visited the Askja in 1884 there was a small pool of hot water in the south-eastern corner of the cauldron, whereas in 1907 a large lake was found partly covered with a sheet of ice. The breadth of the cauldron, which lies in the Dyngufjöll, is about 5½ miles, and the lake, named the Knebel lake by Fräulein von Grumbkow, measures 2½ to 3 miles across. Close to its northern bank lies a crater sinking to a depth of 260 feet, from which a violent eruption took place in 1875. This was named after the young painter Max Rudloff who perished with Dr. von Knebel. Dr. Reck, who accompanied the authoress, descended by a rope to the edge of the boiling sulphurous water in the crater. Both books are profusely illustrated.

W. A. T.

'Guide to Avebury and Neighbourhood.' By R. Hippisley Cox. (London: Stanford. 1909. Pp. 68. *Maps*. 2*s*.) This is a useful brief guide to a prehistoric site which, if of less popular interest than Stonehenge owing to the less perfect condition of the remains, is of even deeper interest to antiquarians. The book is carefully mapped, and deals almost entirely with prehistoric remains; the references to places and buildings of historic interest in the Avebury district are somewhat exiguous.

'The Historic Thames.' By H. Belloc. (London: Dent. 1909. Pp. 204. 3*s.* 6*d*). This little book is by a master of a pleasant style, and presents the story of the Thames in a characteristically pleasant vein, without any effort towards originality. The volume is hardly so well produced as those of other similar series.

"Cambridge County Geographies." 'Cambridgeshire.' By T. M'K. and Mary C. Hughes. (Pp. xii., 271.) 'Cheshire.' By T. A. Coward. (Pp. x., 207.) (Cambridge: University Press. *Maps and Illustrations.* 1*s.* 6*d.* each.) The authors, editor, and publishers of this series continue a good work. These volumes bulk larger than earlier ones, and maintain their standard, that on Cambridgeshire being especially well done. Moreover, it possesses an index—an adjunct which has not been regarded as necessary in other volumes, and this is a move in the right direction.

'High Albania.' By M. Edith Durham. (London: Arnold. 1909. Pp. xii., 348. *Maps and Illustrations.* 14*s.*) From this authoress we anticipate, by experience, a volume full of entertainment and clever observation on any part of the Balkans which she may have visited. The present work is no disappointment, and renews our admiration at once for her writing and for her boldness as a traveller, for her wanderings in Albania were often over almost untrodden roads.

'A Military Consul in Turkey.' By Captain A. F. Townshend. (London: Seeley. 1910. Pp. 328. *Illustrations.* 16*s.*) The author is able to discourse both gravely about Turkish political and administrative problems and gaily about his own peculiar experiences. His official duties led him far afield, and his book would be well worth the attention of intending travellers to Asia Minor.

ASIA.

TIBET.

'Trans-Himalaya: Discoveries and Adventures in Tibet.' By Sven Hedin. In two volumes. London: Macmillan & Co., Ltd. 1909. 30*s. net.*

There is no necessity for a long or detailed examination of this book from a geographical point of view, because it is the popular edition, and will hereafter be followed by one on a still larger scale with scientific results and finished maps. Moreover, in this *Journal* of April, 1909, Hedin's paper on his journeys is published, as are the discussions and his reply which followed. It is therefore now considered less as a contribution to the science of geography than as a narrative of the author's travels and trials. These were unquestionably many and great, some natural, others provided by men, but were overcome by a perseverance, resource, and courage which command our admiration.

Dr. Hedin left Stockholm in October, 1905, and travelled by Constantinople to Seistan, on the East of Persia; thence to Nushki and Quetta, eventually arriving at Simla in May, 1906. Here he found that he was prohibited from entering Tibet from British India, but was made a guest by Lord Minto, the Viceroy, and during his stay at the Viceregal Lodge shared in various festivities which are well and amusingly described. Here, too, he hatched plots whereby he might effect his purpose, and in furtherance of them he set forth to Srinagar, where he stayed with Sir Francis Younghusband. Soon he went on to Leh, where his camp was finally arranged, and departing thence, ostensibly for Khotan and Turkistan, he found himself ere long in Aksai Chin, in north-west Tibet or on its border. For, as he says, this is a country which belongs to no Power. Is it part of Kashmir, or Tibet, or China? There are neither boundaries nor boundary stones. "From here, therefore, I could move eastwards without acting in direct opposition to the wishes of the English Government, and the Chinese would certainly forgive me for not using their passport."

So he set off, and had a rough time on the way to Lake Lighten, on which he

and his canvas boat went through many graphically described perils, but escaped. Thence he passed Lake Markham and turned southwards across Chang-tang to the Ngangtse lake, on which he spent the last night of 1906. Then, after the usual delays and deliberations consequent on the Tibetan authorities desiring him to return the way he came, and his natural repugnance to that course, they suddenly came to the conclusion that the simplest way of getting rid of responsibility was to pass him on to the next province across the Brahmaputra. This suited the traveller's plans, and to that decision Sven Hedin and his readers owe some most interesting chapters about Shigatse, Tashi-Lunpo, the Tashi Lama, and the ways and customs of the lamas. He was present at the losar, or new year's festival, which lasts fifteen days, the greatest of the four annual ceremonies. It celebrates the victory of true religion over infidelity, and is held early in February. The country people flock there and all are admitted, no distinction being made between rich and poor. The descriptions of the ceremonies, illustrated as they are by some of Hedin's extremely clever sketches, are of great interest to many besides geographers. The Tashi Lama made a favourable impression on the author, and is greatly praised.

Leaving Shigatse, he marched up the Brahmaputra, and remarks on "the violent storms from noon onwards which blew in our faces;" that is, from the west. "We were pestered with sand, which grated under our teeth, irritated our backs, and made our eyes smart. Where the valley was contracted, the compressed wind blew with double strength, and the sand-clouds rolled in a greyish-yellow mass along the Brahmaputra valley." Farther on he describes the peculiar country he was passing through on the northern bank; lakes and swamps surrounded by sandhills 26 feet high, and responsible for a plague of gnats. Here floods wash away the driftsand and deposit it lower down, but as the river falls fresh sand accumulates and new dunes are made. The country reminded him of Lob in Chinese Turkistan and the struggle there between sand and water.

On this journey Hedin diverged southwards to investigate the headwaters of the Kubi-Tsangpo, which he states is the chief source of the Brahmaputra, and thence he proceeded to the famous lakes Mánasarowar and Rákas-tál, the former of which furnishes drink for the gods and is sacred to them, whilst the latter, judging from its name, is the lake of evil spirits. With Mánasarowar Hedin was enchanted, and he apostrophizes it thus: "Wonderful, attractive, enchanting lake! Theme of story and legend, playground of storms and changes of colour, apple of the eye of gods and men; goal of weary, yearning pilgrims, holiest of the holiest of all the lakes of the world, art thou, Tso-mavang, lake of all lakes. . . . That is Mánasarowar, the pearl of all the lakes of the world."

On Rákas-tál he was blown in a storm to an island, a single rock falling sheer into the water. It is a breeding-place for wild geese in spring, and even when he was there he found thousands of eggs in nests of stone and sand.

The celebrated mountain Kailás lies north of these lakes, and is a great place of pilgrimage for Hindus and Tibetans. Its peak bears a striking likeness to the dome of a Hindu temple, whence, some say, comes the veneration accorded; the Tibetans call it Kung-rinpoche, "The holy ice mountain," and find its shape similar to a chorten.

From this neighbourhood, say within a radius of a hundred miles from Kailás, four rivers rise: the Indus and Sutlej, eventually flowing westwards and south; the Brahmaputra flowing east and south; and the Mapcha-kamba, or Karnali, which falls into the Ganges. These rivers are known as the lion, the elephant, the horse, and the peacock.

Hedin was sent back towards Leh, but before arrival he turned north and again found his way east to make another crossing of the unknown land; he finally returned to Simla by the Sutlej route.

Though discovery in its full sense is scarcely the word to be used in connection with his travels, Hedin has undoubtedly made great additions to our knowledge of these parts. By traversing in several directions the corrugated mass of hills which lie within the blank portion of the Society's map of Tibet (1906), south of the routes of Nain Singh, Bower, Littledale, and others, and north of the Tsangpo or Brahmaputra, he has unquestionably reduced the space which bears the word "UNEXPLORED." For this he is entitled to our warm congratulations and thanks, though, with Colonel Burrard, we realize that at present we have to be content with approximations to truth; in respect, however, to the discoveries of the chief sources of the Indus, Sutlej, and Brahmaputra, whilst fully recognizing the value of his work, we hold that claims to have found the true source of this river or that are of little value. The source or sources of every river are the areas of the catchment basin, the ultimate source being the rain or snowfall. One source or channel may carry more water one day, another more the next, and to dogmatize as to one stream rather than another being the true source of a river is unprofitable at any time, and probably incorrect till minute and accurate surveys have been made and discharges observed.

The author is anxious to have the range through which he has travelled called Trans-Himalaya, whilst others object to that designation. There is no doubt that name is open to objection for the sufficient reason that when placed north of it, it becomes Cis-Himalaya; yet many persons well qualified to form an opinion are content that it should be adopted. In this country the feeling seems to be that the name does not matter much, and therefore the traveller's wish may be respected; in India it is believed that the senior officers of the Survey Department dislike the name, preferring the old name, Kailás range. The dispute is one of those matters which, if left alone, will settle itself.

It may be noted that the author, whilst paying deserved tributes to the Survey officers and to the pundits who visited the country many years ago, has a somewhat unfortunate way of referring to the relative importance of his work and theirs. This is a pity; when the country is accurately surveyed—should that ever happen—his present sketch-maps will be found to require many corrections, yet that does not detract from their present value.

The volumes, which have been rapidly put together, would have gained by judicious compression; even as they are, the story is incomplete and a third volume is promised; but it is fair to add that they abound in interest and will appeal to a considerable and important section of the public. It is not quite clear whether Sir Sven Hedin—for he is now K.C.I.E.—is responsible for the English edition; an announcement was made in the *Athenæum* that "the rendering it embodies was made for Messrs. Macmillan & Co. by Mr. W. A. Taylor." This is not very clear, but, anyhow, there are few mistakes, and they are of little consequence. The illustrations are numerous and good, those from the author's pencil being conclusive as to his artistic skill. The publishers, too, are to be congratulated on the good type and general turn-out of the book.

W. BROADFOOT.

A JAPANESE PILGRIM IN TIBET.

'Three Years in Tibet.' By the Shramana Ekai Kawaguchi. London and Madras: Theosophical Publishing Co. 1909. *Map and Illustrations. Price* 16*s. net.*

This narrative, from the pen of a Japanese monk, deals with three years' exploration and residence in Tibet. Much of its peculiar interest arises from the fact that it presents us with a faithful picture of that strange country from an Asiatic and not from a European point of view, and thus reminds us strongly of Sarat Chandra Das's well-known journals. The similitude is not surprising

considering that the author spent most of the year 1898 in Darjeeling, and thus had the advantage of receiving both instruction and counsel from the redoubtable S.C.D., who appears to enjoy quite a dignified position there. Mr. Kawaguchi then passed on to Tsarang, in Nepal, where he stayed about fourteen months. All this time he was diligently studying Tibetan, so that when he finally set off for the forbidden land by a pass leading in the direction of Lake Manasarowar, he had quite mastered the Tibetan language. His route lay round the lake and Mount Kailas, and then eastward to Lhasa, along the northern side of the Sanpo by way of Tadum and Shigatze. In the course of this journey the author suffered extraordinary privations owing to inadequate equipment, as well as to the fact that for the first part of the route his only companions were two sheep, which carried his provisions and stores. On arrival at Lhasa, he applied for admission to the Sera monastery, and through his knowledge of the Buddhist scriptures and skill as a doctor he established a good reputation and became very popular. Eventually he was presented to the Dalai Lama, who received him very favourably. This was previous to the despatch of the Younghusband Expedition, and the prevalent feeling at that time was strongly anti-British. The daily life in Lhasa, the manners and customs of the Tibetans, their trade and industries, and the curious negotiations with Russia, culminating in the despatch of several camel-loads of firearms and ammunition,—all these topics are handled in most interesting fashion. Mr. Kawaguchi's book is put together with more literary skill than Sarat Chandra Das's older narratives, and its fuller and more recent information combine to make it probably the best and most up-to-date description of a country which is bound for some time to come to exercise a mysterious fascination over the Western reader.

AFRICA.

The Partition of Africa.

'The Map of Africa by Treaty.' By the late Sir E. Hertslet, K.C.B. Third edition, in three volumes, and a collection of maps. Revised and completed to the end of 1908 by R. W. Brant, Librarian and Keeper of the Papers, and H. L. Sherwood, of the Foreign Office. London: Printed for His Majesty's Stationery Office by Harrison & Sons, St. Martin's Lane. *Price* £3.

Sir Edward Hertslet's 'The Map of Africa by Treaty' was first published in 1895; a year later a revised edition appeared. Since 1896 changes of importance in the political colouring of the map have been made, such as the wresting of the Eastern Sudan from the Khalifa and the renunciation by Italy of her claim to a protectorate over Abyssinia. Minor changes, caused chiefly by the delimitation of boundaries, have been very numerous. Hence the appearance of a third edition of the book is very welcome. The work of revision has been ably accomplished by Messrs. Brant and Sherwood, who have included all treaties and agreements involving territorial changes in Africa concluded down to the end of 1908. The first volume is now devoted entirely to British colonies, protectorates, and other possessions. These have been grouped in three distinct divisions: (1) West Africa, (2) South and Central Africa, (3) East Africa. (The Anglo-Egyptian Sudan, which owns a double sovereignty, is given under Egypt.) In the second edition, British possessions had been given alphabetically, and were not placed in a separate volume. The new arrangement will be found convenient. In this first volume can be traced the successive steps by which the boundaries of British possessions have been fixed, references being given to the texts of the agreements between Great Britain and other Powers contained in volumes **2** and **3**, where also will be found all treaties between states other than the United Kingdom. Colonel Close's valuable map

and table (revised to January, 1909), showing the progress made in the delimitation of British frontiers in Africa, has been reproduced from the Colonial (Survey Committee's) reports; this adds distinctly to the value of the work.

Another change of importance in the book is the addition of a separate case containing forty-five maps, of which one is a general map of Africa, and the others reproductions of maps attached to original documents. They date from 1895 to 1908, and the great majority illustrate agreements to which Great Britain was a party; a few, such as the map showing the French Congo and Cameroons frontier, are of foreign possessions on both sides. Where these large-scale maps are given diagram maps have been bound up with the text, and in all other cases the best available map will also be found bound with the text.

In revising the work the editors have taken the opportunity of inserting many documents omitted from the earlier editions. The present edition is therefore much more valuable than its predecessors. It does not contain every document relating to territorial changes (for instance, the agreement concluded in 1890 by which Lewanika acknowledged the supremacy of the British South Africa Company in Barotseland is not mentioned), but its omissions are of no great consequence. The editors seem to be in error in stating (p. 285) that Nyasaland territory was ever administered by the Chartered Company; the documents cited, pp. 278–280, do not bear that construction, and the fact is that it was part of Rhodesia which was for a time under the control of the commissioner of Nyasaland, not *vice versâ*. With regard to the transfer of the Independent State of the Congo to Belgium, no mention is made of the "Additional Act" (to the treaty of cession of November, 1907) of March 5, 1908, abolishing the *Domaine de la Couronne*. Possibly the annexes of the treaty of 1907 were remodelled so as to secure the object of the "Additional Act"; the point might be cleared up had a summary of those annexes been given. Criticism of this kind serves, however, but to show the general excellence of the work.

F. R. C.

South African History.

'South Africa from the Great Trek to the Union.' By Frank R. Cana, F.R.G.S. London: Chapman & Hall. 1909. 10*s.* 6*d. net.*

As indicated by the title and clearly stated in the preface, this is mainly a politico-historical work, dealing with the period of South African history which runs from the Great Trek movement (1836) to the present Union (1909). On the strictly historical section, which occupies the bulk of the volume, we need not dwell, beyond remarking that the claim to have treated without bias the stirring events here recorded is fully justified, due consideration being paid to the rivalries and aspirations of the two paramount British and Dutch races.

We turn, therefore to the concluding chapter, in which a summary, but on the whole very accurate, survey is given of the broad features of the region between the Cape and the Zambezi, its geographical outlines, climate, topography, inhabitants, products, and economic condition. Here the outstanding impressions made on the traveller moving northwards are vividly depicted, and we read how the successive ranges rise abruptly from the coastland to the vast inland plateau; how isolated hills, some flat-topped, some pointed, are passed; and how all the features of the ascending karoos are repeated on an enlarged scale on the veld, the inner and limitless plain which stretches away from the last inner range to the Zambezi. The air is clear and exhilarating, the rolling grass-covered downs give the impression of the sea, from which tafelberg, kopje, and rand rise like islands. But the English visitor feels a great sense of loss—there are no trees, nor is there any running water, even the Orange and the Vaal and all the other streams being empty

before the rains. "The reflective stranger who has seen these waters allowed to empty into the ocean and leave the land on either side still an arid wilderness cannot but regret that South Africa has not an irrigation system like that of Egypt or India."

Some attention is paid to the Kafir and coloured problems, and reference is made to Mr. F. W. Bell's valuable paper on "The Native as a Political Factor" (1908). But the Bechuanas are wrongly stated to be the first Bantu arrivals from the north some time before the sixteenth century. They were most probably preceded by the Zulu-Xosas, if not by the Ova-Herero, some thousand years ago. Nor do these Herero speak a Hottentot language, but a very pure and typical Bantu tongue. It is their cousins, the Hill Damaras, that have become Hottentots in speech.

There is a not too full index, besides two serviceable maps, one showing the growth of British South Africa, the other the same region under the Union Act of 1909.

A. H. K.

'Loi sur le Gouvernement du Congo Belge.' (Luzac & Co., Great Russell Street, W.C. 1909.) This is a valuable compilation giving in parallel columns the text of the various proposals considered by the Belgian chamber for the government of the Congo, including the law as finally voted in 1908. Thus can be traced the numerous modifications in the direction of parliamentary control which were made by the legislature, before it consented to the transfer of the Congo to Belgium. The discussions in the famous Commission of XVII. and in the legislature on the proposals of 1907 and 1908 are also summarized, and an analysis is given of the abortive *projet de loi* of 1901. This laborious task has been accomplished by Mr. J. Tourney-Detillieux, an ex-senator and deputy and member of the colonial council. The arguments put forward on all sides appear to be impartially stated. Had the text of the treaty of annexation been given, the usefulness of the volume would have been increased.

AMERICA.

Panama and Ecuador.

Dr. E. Festa, 'Nel Darien e nell' Ecuador. Diario di Viaggio di un Naturalista.' 1909. Unione Tip.-Editrice Torinese, Torino. Pp. 397. *Price* 10 *lire*.

The author, who had previously journeyed in Tunis, Lower Egypt, and Syria, set out in 1905 to the Panama peninsula, where he made excursions to the Rios Tuyra, Sabana, and other streams flowing into the Golfo de San Miguel, and then sailed southwards to Ecuador. Here he spent several months in the east of the province of Azuay, among the headwaters of the Rio Santiago, which he wished to descend to the Pongo de Manseriche, but was prevented by the difficulty of procuring porters. He then travelled northwards through Riobamba, Quito, and Ibarra to Tulcan, and would have proceeded to the source region of the Rio Aguarico if the Columbian Government would have allowed him. He also visited the forests of the Rio Daule. Dr. Festa made a rough traverse of the country about the source streams of the Rio Santiago, and his observations and those of Señor Giacinto Pancheri are utilized in a map based on those of older cartographers. On the whole, however, his work is of interest to the zoologist rather than to the geographer. He made large collections of specimens from all sections of the animal kingdom, and discovered many species new to science. A list is given at the end of the volume, but much of the material has yet to be worked up, and therefore the value of the collections cannot at present be fully appreciated. Notices of the distribution of the fauna are numerous throughout the work. Dr. Festa also collected some

ethnological objects, and describes the habits and customs of the Jivaros and other tribes with which he came in contact during the two years and a half he spent in the country. The work is illustrated by seventy-two photographs and two maps.

W. A. T.

Explorations in Southern Brazil.

'Commissão Geographica e Geologica do Estado de S. Paulo.' Exploracão do Rio Tieté 1906 (1907); Exploracão dos Rios Feio e Aguapehy, 1905 (1906); Exploracão do Rio Peixe, 1907 (1907). Folio.

The Geographical and Geological Commission of the State of S. Paulo has recently been carrying out a survey of the Paraná and its more important tributaries in the State with a view to the development of the country, which has hitherto been seriously retarded by the hostility of the Corôados, a tribe of Indians who receive their name from the crown of feathers that forms their headgear.

There are five important streams that flow north-westward through the state and empty themselves into the Paraná. These are, commencing from the north-east, the Rio S. José dos Dourados, the Rio Tieté, the Rio Aguapehy, the Rio do Peixe, and the Rio Santa Anastacio. Of them the Tieté is the most important. It rises in the Serra do Mar close to the Atlantic, and flows across nearly the whole breadth of the state. The upper portion being already well known, the recent expedition under the leadership of Senhor George Black Scorrar only explored the portion between Laranja Azeda at the mouth of the Jacaré Guassú (or Jacaré Grande), and the Paraná.

Senhor Guilherme Florence furnishes us, however, with an interesting account of the geology of the whole stream. It flows through granite and crystalline schists, except where it traverses the small Tertiary basin on which the capital of the state is built. At the Salto de Ytu it passes into sandstone and shales, which are probably of Upper Carboniferous age. Here it is interrupted by a number of rapids, which, above Porto Feliz are usually formed of sandstone, and below, of a rock described as a "diabase porphyrite." About 15 miles above the mouth of the Sorocaba the river enters a region in which sandstone and shales are interstratified with fossiliferous limestone and chert of Permian age. The massive red Botucatú sandstone, which is believed to be of Triassic age, is next encountered. It first comes in below the point where the river Piracicaba enters the main stream, and extends into the tract examined by the expedition. Interstratified with it are flows of "diabase," the outcrops of which, often repeated by faulting, give rise to numerous rapids and cataracts. On the banks the diabase weathers to a red fertile soil known as *terra róxa*. At the port of Cordeiro a still younger formation, the Baurú sandstone, is met with. It is a pale, whitish calcareous sandstone without lava-flows, and for the 43 miles over which it extends the river is deep and with almost imperceptible current, so that it is known as the Rio Morto, or Mansa da Viuva. At the mouth of the Fartura stream the Botucatú sandstone reappears with its lava-flows and its cataracts, of which the most important is the Salto de Avanhandava. Below the Escaramuça rapid the Baurú sandstone appears for the second time, and gives rise to another stretch of quiet water till, at the Salto de Macuco the Botucatú comes in for the third time with the same features as before. It affords, however, one tract of smooth water—the Manso de Lambary—extending over 12 miles from the Corredeira (rapid) de Aracanguá to the Corredeira das Cruzes, and due to the absence of lava-flows. The lavas and cataracts then recommence, and continue at intervals through the remainder of the course of the river, concluding with the magnificent Salto de

Itapura near the confluence with the Paraná, which has itself just passed the Salto de Urubupungá.

The latitude of the more important points were determined by meridian altitudes, but there do not appear to have been any really satisfactory observations for longitude. The altitudes above sea-level were obtained by barometric readings compared with those at the meteorological station at Mattão. These gave a height of 1289 feet for Laranja Azeda, and 889 feet for the mouth, a descent of 400 feet in 230 miles. A calculation based on the levelling of the rapids and falls, and an estimated average slope of the quieter portions of the river of 13 in 100,000 gave practically the same result.

The exploration of the river Aguapehy, known in the upper portion of its course as the Feio, was undertaken by Engineer Olaf Hummel, but on his being wounded by the Indians, Senhor Gentil Moura took over the charge of the expedition. The Feio rises in the Serra de Agudos, apparently at a height of about 2300 feet, and on emerging from a deep and narrow valley unites with the Rio Presidente Tibiriçá of nearly equal size to form the Aguapehy, which is navigable with canoes, though occasionally interrupted by rapids. It finally enters the Paraná at a height of 853 feet after a course of about 435 miles measured from the source of the Feio.

A road was cut through the forest from near the source to the junction of the two streams that constitute the Aguapehy, which was descended to its mouth by a party under second Adjutant Bierrenbach. The land portion of the route was surveyed by tacheometer, the river only by watch and compass. Interesting details are given of the Guarany Indians, and the huts and implements of the Corôados. The flora is described in detail by Senhor Gustavo Edwall. The rocks are mainly sandstone, but diabase outcrops give rise to the cataracts.

The next tributary of the Paraná is known at its source as the Rio do Peixe, and at its mouth as the Rio do Tigre. It was explored under the direction of Senhor João P. Cardoso. It rises at a height of about 2000 feet, and for 100 miles flows with a somewhat rapid current, but is uninterrupted by falls, except one less than 2 feet in height. A tract about 12 miles in length follows with numerous rapids and three cataracts, the greatest of which is more than 25 feet in altitude. The river then flows slowly on for 118 miles in a series of meanders to its junction with the Paraná at a height of 837 feet above sea-level. Detailed information is afforded with regard to the Corôados and other tribes.

These publications are furnished with charts on the scale of 1 : 50,000 (1¼ inch = 1 mile) and a large map on a scale of 1 : 500,000 (1 inch = 7·9 miles), as well as with other maps and profiles and numerous reproductions of photographs.

J. W. E.

'Guide-book to the Lake Louise Region.' By W. D. Wilcox. (Washington, D. C.: Judd & Detweiler. 1909. Pp. 54. *Map and Illustrations.*) This may be recommended as an excellent guide to this most beautiful region of the Canadian Rockies. The photographs do justice to the scenery, the large map shows routes and elevations clearly, and the text carefully appraises the various view-points and the ease or difficulty of the routes. There are some valuable climatological notes from the author's own observations, and numerous hints as to camping and equipment.

'The New North.' By Agnes Deans Cameron. (New York: Appleton. 1910. Pp. xx., 398. *Map and Illustrations.*) The authoress of this volume travelled from Chicago by way of Winnipeg, Edmonton, and the Athabasca to the mouth of the Mackenzie, a sufficiently venturesome journey. She paints her experiences in

glowing colours, and gives a clear picture of the present state of the outposts of civilization and the economic possibilities in the far North-West. She also provides tables of travel rates, times, and distances, where transport is more or less organized beyond the limits of the railway, and pending further developments these may be found useful.

'Camps and Cruises of an Ornithologist.' By F. M. Chapman. (London: Hodder & Stoughton. 1908. Pp. xvi., 432. *Illustrations.* 12*s.*) There is a peculiar fascination about the narrative of the daily life of birds as observed at close quarters in many lands. This book is enhanced in interest by some very fine photographic studies of birds.

'The Picturesque Hudson.' By Clifton Johnson. (New York: Macmillan. 1909. Pp. xiii., 227. *Illustrations.* $1.25.) Messrs. Macmillan no doubt find in America a demand for such picturesque topographical books as their London house produces in the "Highways and Byways" series and others. This volume belongs to the "Picturesque Rivers" series, and is well written and illustrated with photographs.

'In an Unknown Land.' By Edward Robinson. (London: Elliot Stock. 1909. Pp. xi., 155. *Illustrations.* 3*s.*) In this unpretentious volume the author gives good reason for his belief in the commercial future of Labrador as a mining or lumbering region, if its physiographical difficulties can be overcome. He describes the country and his experiences in a simple and easy style, and shows himself to be possessed of the power of scientific observation.

EXPEDITION OF H.R.H. THE DUKE OF THE ABRUZZI TO THE KARAKORAM.

On February 16, H.R.H. the Duke of the Abruzzi delivered a lecture before the Italian Alpine Club on his recent expedition. It is, of course, impossible to deal with the scientific results which he has gathered until the maps and other records are published *in extenso*. But treated merely as a mountaineering exploit, there are very sufficient grounds for congratulation, and the high level of the duke's long record of successes is more than maintained by his latest effort.

Leaving Srinagar on April 23, the Zoji La was crossed to the Indus valley, in spite of wintry conditions on the pass, which was not officially open until the middle of May. Travelling with remarkable rapidity, the expedition arrived on the upper Baltoro glacier within a month from the start. The goal of the expedition lay among the great circle of peaks surrounding the head of the Baltoro glacier; and if K_2 was the first objective, it was always contemplated that one of the other giant peaks in its neighbourhood might afford a better chance of success. This, indeed, turned out eventually to be the case. From a base camp halfway up the Baltoro glacier, a light camp was pushed up to the foot of the southern wall of K_2, and from here the mountain was thoroughly explored in various directions. But no route promising any reasonable hope of success could be detected even by the trained eye of experienced mountaineers. The whole mountain on this side proved to be very

steep and only too well protected by hanging glaciers. The only safe routes lay up arêtes so steep and difficult that it was impossible to carry up even the lightest equipment, and though a fair altitude was reached on one of these ridges, the attempt had to be abandoned.

The west side of K_2 proved only slightly less uncompromising, and with great difficulty the Duke reached a high col on the waterparting overlooking the upper Oprang valley—a region which has been traversed only by Younghusband. All hope of ascending K_2 being now abandoned, the expedition proceeded with the survey of the upper basin of the Austen-Godwin glacier. From a ridge south-east of Staircase peak the Duke obtained a view of the northern precipices of K_2, and got a most important sight of the unknown country to the east, which lies beyond the Oprang glaciers explored by Younghusband in 1888, and to the north of the main Karakoram waterparting.

The only very high mountain in the neighbourhood the conquest of which seemed at all practicable was Bride peak (25,110 feet). Though the best of the season (June) for high ascents was now over, it was decided to attempt this peak. After returning to the main base camp a secondary base was established, apparently in the neighbourhood of Conway's "Footstool camp," north of Bride peak and west of Golden Throne. With considerable difficulty, owing to the broken and crevassed nature of the glacier, a temporary camp was established at a height of 21,000 feet on the Chogolisa saddle. In this terribly exposed situation, and with only the bare necessities of life, the Duke remained for three weeks. Such a feat is quite unprecedented in the annals of mountaineering. The degree of courage and endurance necessary to withstand the physical and mental strain of so prolonged a sojourn at such an altitude can only be realized by those who have actually experienced the dispiriting and debilitating effects of very low atmospheric pressures. That the strain was borne for so long a time must give encouragement to those who have maintained that the highest peaks on the globe are not beyond the powers of exceptional individuals, provided that the other conditions are also favourable.

In the present instance frequent fogs and snowstorms greatly hindered the party, and enormously increased both their difficulties and the risks they ran. Their highest camp works out at about 22,400 feet, the greatest altitude by several hundred feet at which human beings have passed a night. Two definite attempts were made to climb the peak by its eastern arête. On the first, a height of 24,000 feet was reached. This in itself would have constituted a record, for no one else has ever claimed to have actually reached this height on any mountain. But this was surpassed on July 18, when the Duke and two guides reached a height of 24,583 feet. Here, within 500 feet of the summit, a dense fog with wind and snow stopped the party. The ridge was badly corniced, and it was impossible to advance in such weather

without running a risk such as no experienced mountaineer would consider justifiable. The party remained three hours at this spot in the hope of the weather clearing, and had it done so it is certain that the summit would have been gained and the level of 25,000 feet above the sea successfully passed. Every English climber will regret that so gallant an attempt was not crowned with complete success. But as it stands, these two climbs on Bride peak and the three weeks' bivouac on Chogolisa saddle surpass all previous achievements in the annals of high mountaineering. T. G. L.

THE MONTHLY RECORD.

EUROPE.

The Fichtelgebirge in Literature.—A Leipzig dissertation by G. Schultze deals comprehensively with the Fichtelgebirge as a geographical unit. The author treats successively of the development of knowledge of the range, its limits at various epochs, its structure and drainage, communications, mineral resources, settlement, nomenclature, etc., each aspect being appreciated in its causal relations with every other. No general summary of its contents is here possible, but a few notes may be given on the Fichtelgebirge as known to successive ages. The "Hercynian forest" of Aristotle becomes in Strabo the *Gabreta Silva*, and in Ptolemy the Asciburgian and Sudetian mountains. Of the Bohemian rivers, ancient geography knew only the lower courses of the Main, Saale, and Naab. The discrimination of the Fichtelgebirge from the Bohemian *massif* was effected through the intercourse, dating from before the time of Charlemagne, across the passes severing it from the neighbouring mountains. The Ebstorf map (thirteenth century) shows the neighbouring headstreams of the Danube, Rhine, Main, Saale, and Naab. Matthias of Kemnath, who died in 1478, lingers in his *Chronicle* with exceptional detail on the mountains of his childhood: "a mountain high and broad, belonging half to the Palatinate and half to the Margravate of Brandenburg." The Fichtelgebirge, according to this author, has a circumference of 6 miles, "good measure," and, as centre of a great river-system, the double Fichtelgebirge is the most important mountain in Germany, visited by pewterers and shingle-makers, but otherwise only by murderers and robbers. He describes its lake, not frozen in winter nor frequented by bird or fish; its abundance of trees; its gems and minerals; the pedlars who carry away its schorl, selling it at Venice at five florins the bagful; the snows which sometimes bury its villages. A visit to the mountain in 1502 called forth from the poet-laureate Celtes a series of poems, celebrating the four rivers all issuing from the lake at the summit. Specimens of the laureate's and of Michael Barth's later description (1556), reproduced in German hexameters by Prof. Partsch, are included in the monograph. Starting at the sources of the Danube and Neckar, the Hercynian forest of Celtes embraces Eichstädt, Nuremberg, Sandland, and the Noric region, throwing off from the Fichtelgebirge four "giant horns" to the four quarters of heaven, and walling in Bohemia on every side. A map on his title-page shows the four rivers issuing from one lake. A more exact topography is to be found in Bruschius (1542), Willen (1692), Pertsch (1677), and in later writers. On the evidence of his own eyesight, Bruschius locates the source of the Eger on the mountain named "Heid." The altitude of the range as now known is a huge come-down from the 42,000 feet once assigned it.

ASIA.

An Expedition to North-West Mongolia.—An expedition organized by Mr. Douglas Carruthers, in conjunction with Mr. J. H. Miller and Mr. M. P. Price, who are financing it, will leave England at the end of March for North-Western Mongolia. The chief object of the expedition is to explore zoologically, botanically, and, as far as possible, geographically, the basin of the upper Yenesei river. The journey out will be made through Russia and Siberia to Krasnoyarsk, and thence up the Yenesei to Minusinsk. Here the expedition will fit out, and, leaving Russian territory, pass over into Chinese Mongolia. The upper Yenesei and its tributaries are almost completely surrounded by high mountain ranges, which form a secluded basin. In this basin dwells a curious tribe, the Sayotes, who appear to be confined to this restricted area. On the completion of the work in the actual basin of the upper Yenesei, the expedition will pass through Dzungaria to Kulja, which will be reached some time in November. After this Mr. Carruthers and Mr. Miller hope to winter in the Tarim basin, and then to continue their explorations in the spring in the Chinese provinces of Kansu and Alashan. That there is much of interest to record about the tribes of this region is shown by the fact that it includes the original homes of the Turkish and Finnish races. Zoologically, the Yenesei is important as being the line of demarcation between the faunas of eastern and western Siberia. And if the expedition is able to reach Alashan and neighbouring regions, there will be valuable geographical work to be done and problems regarding the desiccation of Central Asia to be solved.

AFRICA.

The Railway System of the Anglo-Egyptian Sudan.—The following information as to the Sudan railways has been communicated from an official source. In January, 1910, the following lines were open to traffic: (*a*) the line from Wadi Halfa to Khartum *viâ* Abu Hamed and Atbara junction; (*b*) the line from Atbara junction to the Red sea; (*c*) the branch line from Abu Hamed to Kareima in the Province of Dongola; (*d*) the extension southwards from Khartum to Wad Medani on the Blue Nile. The railway line from Wadi Halfa *viâ* Kosha to Kerma, which was completed in 1897, was dismantled and pulled up in 1905; the Dongola province being now reached by the Abu Hamed-Kareima line, (*c*) above, which, like the Nile Red Sea railway, was opened in 1906. The terminus of the Halfa-Khartum line is on the right bank of the Blue Nile opposite the city of Khartum, and the first step necessary towards its further extension was the construction of a railway bridge over the Blue Nile. This is to be completed and opened for traffic in the spring of 1910. Work on it was, however, in a sufficiently advanced stage in April, 1909, to admit of construction-trains being passed over carrying material for the extension southwards, and this reached Wad Medani (110 miles from Khartum) in December, 1909. During 1910 the line will be further extended to Sennar, and then westwards to Rabak on the White Nile, in N. lat. 13° 8′. The bridge to carry the railway across the White Nile at this point is now in course of construction, and will, it is hoped, be completed by the end of 1910. The route from the White Nile to El Obeid has not definitely been decided in all its details, but it will probably make a slight *détour* to the northwards as far as Kosti, and then turn westward to El Obeid *viâ* El Rehad. The construction of a branch line from Sennar to Singa is under consideration, but it seems probable that the El Obeid extension will have preference.

French Equatorial Africa.—The definite incorporation of Wadai within the territory administered by France, by the occupation of its capital Abesher in June, 1909, has been followed by some change in the organization of the whole territory

formerly known as French Congo, coupled with a change in its official designation. The old name has long been felt to be unsuitable, as the territory so designated stretched far outside the limits of the Congo basin, both on the coast and in the far north, and that of French Equatorial Africa has now been substituted. At the same time, by an order published in the *Journal Officiel* of January 16, the government of the territory will be brought into line with those of West Africa, Madagascar, etc., a distinction being made in matters of finance between the colony as a whole and its subordinate parts. A concise narrative of the events leading up to the occupation of Abesher by Lieut. Bourreau (under the orders of Captain Fiegenschuh) will be found in the *Revue Française* for January, 1910.*

Irrigation in South Africa.—The government of Cape Colony has published a detailed report entitled 'Proceedings of the First South African Irrigation Congress held at Robertson, Cape Colony, on May 18, 1909,' which reviews the progress and prospects of irrigation work in South Africa. The prime minister, the Hon. J. H. Merriman, in his inaugural address on the occasion, spoke of the paramount importance of the union of South Africa, and regarded irrigation as the most essential factor in building up the future of the countries; for favoured by nature as South Africa is in many ways, with a very fertile soil capable of yielding the best products under skill and energy, her great enemy is an arid climate in many parts, and every effort should be made to continue successful irrigation schemes. At present irrigation is largely confined to the Breede valley in the south-west, and to the great river-valleys of the midlands, but during the year 1908 irrigation schemes were taken in hand with an ultimate capacity of some 30,000 to 40,000 acres. The rainfall of Cape Colony averages 15 inches a year, and assuming a 5-per-cent. run off from its area of 276,000 square miles, a water-supply should be available for 3,000,000 acres of irrigation; but before this result can be obtained, more scientific methods of irrigation must become the rule. Moreover, the rainfall is very unevenly distributed, and much of the rainfall in the wet districts where irrigation is not needed could not be made available for the arid portions of the colony. The cost of bringing land under irrigation in South Africa is great, and schemes costing £10 an acre are the most common and financially sound. The amount of modern alluvial land suitable for flood irrigation is moreover limited, and on the uplands the depth of soil is insufficient for its adoption. In South Africa some system of water storage must largely form the basis of successful irrigation works. In the Transvaal the irrigation problem is greatly different from that in Cape Colony; in the latter country "flood" irrigation is prevalent, but in the former the heavier rainfall renders irrigation unnecessary when the rivers are in flood, and attention has to be directed towards the conservation of surplus water for use in dry periods.

Railway Construction in South-Central Africa.—The recent further extension northwards of the Rhodesian railway system into the Katanga district of the Congo Free State brings into prominence the possibility of the practical realization of the scheme for connecting this part of Central Africa with a port on the West Coast. It will be remembered that some years ago the Tanganyika Concessions, Limited, who own large mineral rights in the Katanga district, obtained from the late King of the Belgians the right to build a series of railway lines from Lobito bay into the Katanga district, which adjoins the northern boundary of North-Western Rhodesia. The construction of this railway system has already been commenced, and the line is already about 200 miles from Lobito bay. In the

* The regrettable news has just come to hand of the massacre, in Eastern Wadai, of Captain Fiegenschuh and several other French officers.

mean time, in Rhodesia the railway system was slowly being extended north from the Victoria falls towards the northern boundary of North-Western Rhodesia, which was crossed on December 11 last. There is still a large gap of some 700 or 800 miles to be bridged before railway communication between Rhodesia and the West Coast can be established, but no substantial agreement has been come to on the subject.

AMERICA.

The Pine Trees of Arizona in Relation to Weather Cycles.—An original paper, by Prof. A. E. Douglass, of singular interest, entitled "Weather Cycles in the Growth of Big Trees," appeared in the *Monthly Weather Review* for June, 1909. In a series of curves, the author exhibits a relationship between the variations of the growth of the pines as revealed by a study of the wood rings, and periodicities in the behaviour of temperature and rainfall, which in turn he attempts to correlate with variations of solar activity according to sun-spot frequency. The area considered is the State of Arizona, which, though situated in a low latitude, has a somewhat cold climate due to great altitude. The northern portion of Arizona consists mainly of a great plateau at an average elevation of 6000 feet above sea-level. This region is buried under several feet of snow in winter, and the summer nights are seldom warm enough for sitting out of doors. The San Francisco heights, near Flagstaff, are covered with forests of yellow pine (*Pinus ponderosa*), and these trees are wildly and elegantly scattered over the hills and plains of Arizona. There is a remarkable absence of undergrowth, and in the arid climate of Arizona the chief struggle of the trees is against drought. The author was led, in 1901, to investigate the subject from the consideration that the rings of a tree measure its food-supply, which is largely dependent upon the supply of moisture, and that in a dry climate with little interference from competing vegetation the relationship between the rate of growth of trees and the supply of moisture might be *discovered*. The average age as indicated by the rings of some twenty-five trees selected for study was 324 years. The main results of the investigation, which should be further pursued, may be summarized thus :—(1) The annual tree growth becomes a very close measure of the annual precipitation in the vicinity of the trees. (2) The following periodic variations exist: In tree growth, (*a*) 32·8 years; (*b*) 21·2 years; (*c*) 11·3 years; in weather elements (temperature and rainfall), (*d*) 11·3 years. (3) The 11·3-year period seems to be connected with changes in the output of solar energy; and as the amount of variation in tree growth associated with the 32·8-year period is very great, reaching 25 per cent. above and below the average, while that associated with the 21·2-year period only reaches 7 per cent., and the 11·3-year period 3 per cent., it seems very probable that the cause of the longer variations is to be sought in solar changes of greater magnitude than those revealed by the 11·3-year period.

Expeditions in South America.—The following items respecting expeditions in the field or contemplated in various parts of South America have lately come to hand. Baron Erland Nordenskiöld, who gave the Society the results of a former expedition to the centre of South America in 1906, has returned from a new expedition, undertaken in 1908, to some of the least-known parts of eastern Bolivia, the primitive tribes of which he has studied with success. In the Andean region, the expedition under Dr. W. C. Farabee, referred to in vol. **29**, p. 229, and vol. **32**, p. 533, has completed its labours, returning to the United States last autumn. An interesting piece of work has been done in Central Brazil by a lady traveller, Miss Snethlage (of the Goeldi Museum at Para), in the crossing overland from the Xingu to the Tapajos by a route through country hitherto quite unmapped. The journey was accomplished last summer in the company of Indians,

a tributary of the Xingu being ascended, and a granite range some 1500 feet high crossed to the headwaters of a stream flowing to the Tapajos. Further east, a German traveller, Dr. Kissenbarth, has ascended the Araguaya to Bananal island, making studies of the little-known Indian tribes who inhabit the forests on its banks. Of projected expeditions, the most important is that of Dr. Fritz Reichert and other scientists, who left Buenos Aires at the end of 1909 for the purpose of carrying out a careful survey of the little-known Juncal *massif* in the Andes south of Aconcagua. Besides making ascents of the peaks, the explorers will pay special attention to the glacial features, which appear to be particularly well developed in this group.

AUSTRALASIA AND PACIFIC ISLANDS.

Surveys in New Zealand.—The Geological Survey Office of New Zealand issued in 1908 the second annual report (C–9), dealing with the geology and, to a great extent, also with the topography of several divisions of the Dominion. The report contains a map showing the survey districts and some fine illustrations of mountains and glaciers. The Parapara subdivision, Karamea, Nelson, South Island, has little of special geological interest, but is remarkable from the point of view of physiography and scenery, the area between the Karagarua and Landsborough rivers being particularly striking. The Great Douglas glacier, of which there is an excellent photograph in the report, consists of two distinct parts—the glacier proper or valley portion, and the *névé* portion. The two parts are separated by a rock precipice over 1000 feet high, above which rises a solid ice-cliff forming the southern face of the *névé*. Immense avalanches descend every few minutes from the face of the *névé* over the rock precipice, and these are the principal feeders of the valley portion of the glacier. There are comparatively few large crevasses in the surface of the Douglas *névé*, though there is one large "bergschrund" round the eastern base of Mount Sefton, but thirty-three streams issue from beneath the Douglas *névé* and descend abruptly as waterfalls. The surface of the valley portion, on the other hand, is much broken by crevasses and stacked with moraines, and the soft snow and ice composing it are coloured greenish by comminuted serpentinous rock derived from heights to the northward. Many of the subdivisions and districts of the survey afford considerable economic interest, yielding gold, copper, coal, petroleum, and other mineral products. In the Whatatu subdivision of Raukumara, Hawke's bay, North Island, the chief mineral is petroleum, surface indications of which are conspicuous at Waitangi hill, at the head of the Te Hau-o-te-Atua stream. A small branch of this stream, named Petroleum creek, contains pools through which petroleum gas emanates, leaving a thin coating of oil on the surface of the water, the surrounding soil being saturated with oil, to procure which test-pits have been sunk by various companies.

Exploration in New Guinea.—We regret to record the death, from drowning, of Mr. W. Stalker, a member of the British expedition to western New Guinea, who, as already mentioned in the *Journal*, had proceeded in advance of the rest of the expedition for the purpose of collecting carriers. Mr. Stalker, who was a native of Ambleside, had previously done some good collecting work for the British Museum. The Dutch expedition to the same part of the island, under Mr. A. H. Lorentz (*Journal*, vol. **34**, p. 683), has, according to news received in Holland by telegraph during February, succeeded in ascending a portion of the interior snowy range, reaching the first glacier at a height of 15,000 feet. Mr. Hellwig has continued the survey of the Digul river, somewhat further east, and a party under Captain Weber last year succeeded in pushing across to within a short distance of the Fly river. A new snowy peak, to which the name Juliana was

given, is said to have been sighted from the highest point on the Digul. Some further details as to the programme of the expedition under Dr. Schultze (*Journal*, vol. **34**, p. 683), for the survey of the boundary between German and Dutch New Guinea, are given in *Petermanns Mitteilungen*, No. 2, 1910. Besides the actual surveys, it is hoped to do other work in furtherance of our knowledge of this part of New Guinea. The first piece of survey-work to be undertaken will be the examination of the Tami river, which enters the sea just west of the international boundary.

POLAR REGIONS.

Dr. Charcot's Antarctic Expedition.—The French Antarctic Expedition under Dr. Jean Charcot arrived at Punta Arenas on board the *Pourqui Pas?* on February 11. The following telegram, despatched by Dr. Charcot to Madame Charcot, has been communicated to us: "I think I have fulfilled, as far as my means would allow, the scientific problem which was set us by the Academy of Sciences. After running aground rather badly, we continued towards the south-west the survey of the coast of the Antarctic regions, begun during our former expedition, as far as Adelaide island—a very curious island 130 kilometres (about 81 miles) in length. To the south we discovered a vast gulf, and surveyed 120 miles of new country. We then reached Alexander I. Land, which was the principal goal of our expedition. Adjoining the land was a great deal of ice; the coast was ironbound, and there was no anchorage. Afterwards, returning north, we wintered at Petermann island. The winter was comparatively mild, but trying. The weather was frightful; we suffered considerably, and had several on the sick-list, who are now recovered. Numerous interesting excursions were made, especially on the glaciers. The second campaign included researches among the South Shetlands, notably on Deception and Bridgman islands. Then we again turned south, discovered a new island, and located Peter I. island. We sailed between the 69th and 71st parallels as far as 126° W. long. We hoped to do more, but have done the best we could." According to the map compiled by Dr. Charcot after his former expedition, Petermann island is situated in about 65° 10′ S. lat., 64° 5′ W. long. Other telegrams report that during the winter the members of the expedition were attacked by scurvy, and that the ship was damaged in collisions with icebergs. Both food and coal ran short. New lands were discovered west and south of Alexander I. Land. The ice conditions were unfavourable for the use of the motor-sledges carried by the expedition.

United States South Polar Expedition.—Early in February Commander Peary extended to the National Geographic Society of Washington, on behalf of the Peary Arctic Club, an invitation to co-operate with the club in the organization of a United States South Polar Expedition. This invitation has been accepted by the National Geographic Society. The Peary Arctic Club will contribute the use of the steamer *Roosevelt*, and the National Geographic Society the first £10,000 of the cost of the expedition; beyond that amount the expenses will be borne equally by the two bodies. Commander Peary has contributed personally a sum of £2000, which had been subscribed as a testimonial to him by some of his admirers. It is proposed that the expedition shall sail from the United States towards the end of this year, and establish a base on the opposite side of the Antarctic region to Captain Scott's proposed base in McMurdo sound. This would seem to indicate Coats Land as the base of the American expedition. The attempt to reach the South Pole will be made in the Antarctic summer of 1911–12, when Captain Scott will also be engaged in his attempt to reach the pole. It is understood that Captain Bartlett will again be in command of the *Roosevelt*. Commander Peary will not himself accompany the expedition. Letters which have passed

between him and Captain Scott have been published, and serve to show that the two expeditions will be conducted in a spirit of friendly international rivalry. Captain Scott suggests that there should be co-operation in matters of meteorology and magnetism. A programme might be drawn up which would enable simultaneous observations to be taken by the two expeditions.

Other Proposed Expeditions to the Antarctic Regions.—The announcement was made towards the end of January that, at the suggestion of Dr. H. F. Osborn, the U.S. Department of Commerce and Labour had under consideration the despatch of the government steamer *Albatross* to Antarctic waters for investigations with a commercial as well as a scientific object. It is hoped to discover the haunts of the southern fur seal in some of the remote island groups in or near the Antarctic region; but a study of the southern fauna generally would also be kept in view. Another scheme lately set on foot in America, without, however, apparently coming very near practical realization, is one for an expedition to Wilkes Land for the purpose of verifying Wilkes' discoveries, especially with regard to the continental nature of the lands seen by him in the far south. The idea was started by Mr. E. S. Balch, who on several occasions has come forward as a champion of Wilkes when his discoveries have been called in question, and who set forth the reasons "Why America should re-explore Wilkes Land" in the *Proceedings of the American Philosophical Society*, No. 191, 1909. The Geographical Society of Philadelphia has since, by a unanimous resolution, expressed its approval of the scheme, urging that a suitable vessel should be fitted out under the direction of the Secretary of the Navy. There is no doubt that Wilkes Land would offer a most promising field for an exploration such as is suggested.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

A New Cartographical Instrument.—We are informed that, under the name stereo-autograph, a new instrument was brought into use at the Military Geographical Institute at Vienna in December last. The instrument, which had been under construction by the firm of Zeiss, of Jena, since 1908, after the design of Lieut. E. Ritter von Orel, is intended to facilitate the utilization of stereoscopic views of country taken by means of a field photo-theodolite. It not only renders possible the automatic laying down of contour-lines, but also permits the determination of the position and altitude of any given point, as well as the plotting of any line visible in the picture in exactly the course actually followed by it. Experiments made with the instrument have given results entirely satisfactory in every respect. A detailed description of the instrument and of the results of the experiments is promised at a later date.

Glacial Erosion.—Prof. de Martonne has lately been studying the indications, near the lower ends of glaciers in the Alps in course of retreat, which might help to the solution of the question of glacial erosion. In the *Comptes Rendus* for December 27, 1909, he points out that the bed of glaciers near their termination generally shows a more or less steep incline, largely left bare at the present day, and a relatively level flat covered only at times of maximum extension of the glacier. It is on the latter chiefly that the striæ and other marks of glacial erosion are observable, the steeper slope showing rather the effects of torrential action. Following this up, he finds that in other parts of the glacier the marks of glacial erosion become more frequent where the inclination of the bed becomes less, a fact which is to be explained, in his view, by the closer contact between the ice and its bed at spots where the slope is less. He considers that a general law of an unequal incidence of glacial erosion may thus be formulated, and that a mechanical

impossibility is involved equally by the theories of those who deny, and of those who exaggerate, the effect of glacial erosion.

GENERAL.

The Oceanographical Museum at Monaco.—The inauguration of this museum, founded by the Prince of Monaco as an aid to oceanographical research, will take place, with appropriate ceremonies, on March 29 of this year. Various meetings and conferences will be held, lasting altogether till the evening of April 1.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1909–1910.

Seventh Meeting, January 24, 1910.—Major Leonard Darwin, President in the Chair.

Elections.—*Oris Bates; Colonel Edward Hugh Bethell, R.E.; Thomas Breakell; Samuel Carlisle; William Frederick Collins; Walter William Crawford; Lieut. C. M. D. Enriquez* (21*st Punjabis*); *John Hatfield; Rev. F. Nicholson Heazell; Lieut. Albert Edwin House, R.N.; Hermann Robert Jaeger; Francis Edgar Karithack; Major A. B. Longden* (37*th Dogras, I.A.*); *Theodore Lyman; Harry D. A. Maidment; Commander Harry Cutfield Martin, R.N.; William M. Pearce; Captain G. D. Pike* (9*th Gurkhas*); *Dr. Du Riche Preller, M.L.; George Frederick Riches; Harvey B. Robarts; John Graham Robertson; Commander T. E. Rogers* (*R.M.S. "Ecuador"*); *Eric Piero Shakerley; Sir Henry Babington Smith, K.C.B.; Captain L. D. Spencer* (*Egyptian Army*); *Orlande Sumner; Lieut. G. Tomes* (53*rd Sikhs*); *William Aubrey Willes.*

The President said: Before proceeding to the business of the evening, I have to announce that the Council of this Society has to-day decided to award a special Gold Medal to Commander Peary for having been the first human being to lead a party of explorers to a pole of the Earth, and also for having taken all the scientific investigations the circumstances of his travels permitted; and that also a silver replica of this medal will be awarded to Captain Bartlett, the Englishman who accompanied him to 88° N. latitude.

The paper read was:—

"A Journey in North-Western Arabia." By Douglas Carruthers.

RESEARCH DEPARTMENT.

January 20, 1910.—Dr. A. Strahan in the Chair.

"Sand dunes of the Libyan Desert." By H. J. L. Beadnell.

Eighth Meeting, February 7, 1910.—Major Leonard Darwin, President, in the Chair.

Elections.—*William Aitken; Sir Hugh Shakespear Barnes, K.C.S.I., K.C.V.O.; Walter L. Buxton; Guy F. Cobbold; P. T. Etherton; Terrick Charles Fitz Hugh; G. Alfred Hancock; William John Leonard; Rev. Douglas McLellan; Major Richard Power O'Shee, R.E.; Herbert Phillips; Major Frank Renwick* (40*th Pathans*); *Samuel Edward Tench.*

The paper read was:—

"The Geographical Conditions affecting the Development of Australia." By Prof. J. W. Gregory, F.R.S.

LECTURES ON WAVES IN WATER, SAND, AND SNOW.

By Dr. VAUGHAN CORNISH.

First Lecture, Thursday, February 3, 1910.

On Ocean Waves, and on "Bores" in Rivers.

Second Lecture, Thursday, February 10, 1910.

On Waves in Sand.

Third Lecture, Thursday, February 17, 1910.

On Progressive Snow-waves, and on other Surface Forms of Snow.

LECTURE.

February 25, 1910.

Journey down the Mackenzie River to the Arctic Ocean. By Miss AGNES DEANS CAMERON.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Communications. *Deutsche Rundschau G.* **21** (1909): 481–493. **Meinhard.**
Die Verkehrswege über die Alpen, deren handelspolitische und militär-strategische Bedeutung. Von Friedrich Meinhard. *Map and Illustrations.*

Alps—Inn Valley. *Z. Gletscherkunde* **3** (1909): 52–67, 111–142. **Ampferer.**
Ueber die Entstehung der Inntal-Terrassen. Von Dr. O. Ampferer. *Sections and Illustrations.*

Alps—Valleys. *Z. Gletscherkunde* **3** (1909): 148–156. **Crammer.**
Zur Frage ineinander geschalteter Taltröge in den Alpen. Von Hans Crammer. Erwiderung. Von Hans Hess.

Alps, Eastern—Glaciation. **Hauptmann and Heritsch.**
Sitzb. K.A.W. Wien, I. Abt. **117** (1908): 405–437.
Die eiszeitliche Vergletscherung der Bösensteingruppe in den Niedern Tauern. Von Dr. Ludmil Hauptmann und Dr. Franz Heritsch. *Sketch-map and Diagrams.*

Alps, Eastern—Glaciers. *Z. Gletscherkunde* **3** (1909): 334–346. **Marinelli.**
Il limite climatico delle nevi nel gruppo del M. Canin (Alpi Giulie). Di Olinto Marinelli. *Sketch-map and Illustrations.*

Alps, Eastern—Phytogeography. **Beck.**
Sitzb. K.A.W. Wien, I. Abt. **116** (1907): 1439–1534; **117** (1908): 463–511.
Vegetationsstudien in den Ostalpen; I. and II. Teile. Von Günther Ritter Beck v. Mannagetta und Lerchenau. *Maps.*

Alps, Eastern—Surveys. *Sitzb. K.A.W. Wien, I. Abt.* **117** (1908): 371–404. **Becke.**
Bericht über die Aufnahmen am Nord- und Ostrand des Hochalmmassivs. Von F. Becke. *Sketch-map and Sections.*

Austria—Carinthia. *Deutsche Rundschau G.* **31** (1909): 289–299, 350–357. **Perko.**
Ein geschichtlicher Rückblick auf die Innerkrainer Höhlen und eine kurze Beschreibung derselben. Von G. And. Perko. *Plan and Illustrations.*

Belgium—Place-names. *Deutsche Erde* **8** (1909): 99–104, 139–143. **Warker.**
Die deutschen Orts- und Gewässernamen der belgischen Provinz Luxemburg. Von Prof. Nikolaus Warker. *Map.*

Central Europe—Slovenes. **Peisker.**
Die ältere Sozial- und Wirtschaftsverfassung der Alpenslawen (Slowenen). Gegen Prof. D. Alphons Dopsch, von J. Peisker. (Sonderabdruck aus der Vierteljahrschrift für Social- und Wirtschaftsgeschichte, 7 Bd.) Stuttgart, 1909. Size 8½ × 5½, pp. 14.

Denmark—Bornholm. *XI. Jbericht G. Ges. Greifswald*, 1907–08 (1909): 163–200. **Braun.**
Ueber die Morphologie von Bornholm. Von Dr. G. Braun. *Maps, Sections, and Illustrations.*
See February number, p. 193.

Denmark—Pilot. ———
Den Danske Havne-Lods; udgivet af det Kongelige Søkort-Arkiv. Sjette Udgave; sluttet den 1st August, 1909. Copenhagen, 1909. Size 10 × 6½, pp. 152. *Plans. Price 2 kr. Presented by the K. Danske Søkort-Arkiv.*

Europe—Waterways. **Lindley.**
Royal Commission on Canals and Waterways. Vol. 6. Foreign Inquiry, Report on the Waterways of France, Belgium, Germany, and Holland. By W. H. Lindley. Part I.—Reports and Appendices. Part II.—Maps and Tables. London: Wyman & Sons, 1909. Size 13 × 8½, pp. xii. and 224. *Maps.*

France—Landes. *B.S.G. Comm. Bordeaux* **32** (1909): 217–222. **Bergon and Lalesque.**
Preuves géologiques et biologiques de l'origine marine du lac de Cazaux. Par Paul Bergon et Dr. F. Lalesque.

France—Marseilles. **Léotard.**
Notice sur Marseille et les Bouches-du-Rhône. Le Département. Marseille: Le Port — La Cité. Aix. Arles. Par Jacques Léotard. Marseille, 1909. Size 10½ × 7, pp. 24. *Illustration. Presented by the Author.*

France—Mountain-Economy. *B.S.G. Comm. Bordeaux* **32** (1909): 109–122. **Descombes.**
La première étape de l'Association Centrale pour l'Aménagement des Montagnes. Par P. Descombes.

France—Rochefort. *B.S.G. Rochefort* **31** (1909): 156–166. **Bugard.**
Rochefort-sur-Mer, ses rades et son port. Par le vice-amiral Bugard.

Germany—Bavaria. **Schulze.**
Beiträge zur Landes- und Siedlungskunde des Fichtelgebirges. Inaugural-Dissertation . . . von Gustav Schulze. Borna (Leipzig), 1909. Size 9 × 6, pp. iv. and 128. *Presented by the Author.*
See *ante*, p. 332.

Germany—Main basin. **Grubert.**
Forschungen deuts. Landes u. Volksk. **18** (1909): 1–102.
Die Siedelungen am Maindreieck. Von Dr. Adam Grubert. *Sketch-map and Section.*

Germany—Mecklenburg. **Schulz.**
Die Siedlungen des Warnowgebietes in Mecklenburg. Eine geographische Studie von Dr. Alfred Schulz. (Geographische Arbeiten, herausgegeben von Dr. Willi Ule; IV.) Stuttgart: Strecker & Schröder, 1909. Size 8½ × 6, pp. x. and 44. *Price 2m. Presented by the Publishers.*

Germany—Prussia—Röm. **Moritz.**
Veröffentl. I. f. Meereskunde u. d. G.I. Universität Berlin, Heft. **14** (1909): pp. iv. and 72.
Die Insel Röm. Von Prof. Dr. Eduard Moritz. *Maps.*

Germany—Rhine basin. **Martiny.**
Forschungen deuts. Landes- u. Volksk. **18** (1909): 405–494.
Kulturgeographie des Koblenzer Verkehrsgebietes. Von Dr. Rudolf Martiny. *Maps.*
See February number, p. 193.

Germany—Volcanoes. *Naturw. Wochenschrift* **23** (1908): 769–777. **Reck.**
Die kainozoischen Vulkane Deutschlands und unsere Vulkantheorien. Von Hans Reck. *Sketch-map.*

Germany—Würtemberg. **Scheu.**
Forschungen deuts. Landes- u. Volksk. **18** (1909): 361–404.
Zur Morphologie der Swäbisch-Fränkischen Stufenlandschaft. Von Dr. Erwin Scheu. *Sketch-maps.*
See Monthly Record for January, p. 77.

Greece—Thessaly. *Deutsche Rundschau G.* **32** (1909): 12–19. **Mielert.**
Aus dem östlichen Thessalien. Von Fritz Mielert. *Illustrations.*

Hungary—Historical. *Abrégé B.S. Hongroise G.* **36** (1908): 162–180. **Szakáll.**
Ungarns westliche Grenze im Jahre 1254. Von Zsigmond Szakáll. *Sketch-map.*

Iceland. **Spethmann.**
Der Aufbau der Insel Island. Von Dr. Hans Spethmann. (Separatabdruck aus dem Centralblatt für Mineralogie, Geologie und Paläontologie, Jahrg. 1909, No. 20 u. 21.) Stuttgart, 1909. Size 9 × 6, pp. 16.

Iceland—Glaciers. *Z. Gletscherkunde* **3** (1909): 297–305. **Sapper.**
Bemerkungen über einige südisländische Gletscher. Von Prof. Dr. K. Sapper. *Sketch-maps and Illustrations.*

Iceland—Volcanoes. *Globus* **96** (1909): 201–205. **Spethmann.**
Beiträge zur Kenntnis des Vulkanismus am Mückensee auf Island. Von Dr. Hans Spethmann. *Sketch-map.*

Italy. *Atti R.A. Lincei, Rendiconti* **2** (1909): 401–409. ———
Messina e Reggio nella Storia.

Italy—Seismology. *B.S.G. Marseille* **33** (1909): 1–16. **Repelin.**
L'Italie et ses Regions Sismiques. Les tremblementes de terre de l'Italie méridionale. Par M. J. Repelin. *Diagram.*

Russia—Finland. **Heinrichs and Korhonen.**
Observations météorologiques, publiées par l'Institut Météorologique Central de la Société des Sciences de Finlande. État des glaces et des neiges en Finlande pendant l'hiver 1896–1897; Exposé par Axel Heinrichs et V. V. Korhonen (pp. 58). Ditto, pendant l'hiver 1897–1898; Exposé par V. V. Korhonen (pp. 60). Helsingfors, 1908–1909. Size 13½ × 10. *Maps.*

Russia—Runö. *Globus* **96** (1909): 181–186. **Krah.**
Die Insel Runö und ihre Bewohner. Von Carl Krah. *Illustrations.*

Russia—Ural. **Duparc and others.**
Mém. S. Phys. et d'Hist. Nat. Genève **36** (1909): 33–208.
Recherches géologiques et pétrographiques sur l'Oural du Nord. Le bassin de la haute Wichéra. Par Louis Duparc, Francis Pearce, et Marguerite Tikanowitch. *Sketch-map, Plans, Sections, and Illustrations.*

Russia—Ural. *B.S.G. Lyon*, Ser. II. **1** (1908): 129–149. **Offret.**
L'Oural au point de vue minier et métallurgique. Par A. Offret.

Southern Europe—Karst. *G.Z.* **15** (1909): 185–204, 259–281. **Sawicki.**
Ein Beitrag zum geographischen Zyklus im Karst. Von Ludomir Ritter von Sawicki. *Sections and Illustrations.*

Switzerland—Bern—Caverns. **Heim.**
Vierteljahrsschrift Naturforsch. Ges. Zürich **54** (1909): 52–53.
Ueber die Beatus-Höhlen am Thunersee. Von Arnold Heim. *Plan and Sections.*

Switzerland—Föhn. *Met. Z.* **26** (1909): 165–170. **Maurer.**
Aus langjährigen Aufzeichnungen des Schweizer Föhns. Von J. Maurer. *Sketch-map.*

Switzerland—Lake of Zug. **Nussbaumer.**
Vierteljahrsschrift Naturforsch. Ges. Zürich **54** (1909): 1–51.
Ueber die Verunreinigung von Seen durch Einleitung städtischer Abwässer mit spezieller Berücksichtigung des Zugersees. Von Th. Nussbaumer. *Plan.*

Switzerland—Zürich—Relief. **Hellmund.**
Vierteljahrsschrift Naturforsch. Ges. Zürich **54** (1909): 149–216.
Die Drumlinlandschaft zwischen Pfäffiker- und Greifensee (Kanton Zürich). Von Hermine W. Bodenburg Hellmund. *Maps and Sections.*

Turkey—Albania. **Ippen.**
Skutari und die nordalbanische Küstenebene. Von Theodor A. Ippen. (Zur Kunde der Balkanhalbinsel . . . herausgegeben von Dr. Carl Patsch. Heft 5.) Sarajevo: D. A. Kajon, 1907. Size 9 × 6, pp. iv. and 84. *Illustrations. Price* 2.50*m.*

ASIA.

Central Asia. *M. k.k. G. Ges. Wien* **52** (1909): 289–324. **Stein.**
Geographische und archäologische Forschungsreisen in Zentralasien 1906–1908. Von M. Aurel Stein. *Illustrations.*

Central Asia—Anthropogeography. *G.Z.* **15** (1909): 241–258. **Cholnoky.**
Künstliche Berieselung in Inner-Asien und die Völkerwanderung. Von Jenö v. Cholnoky.

China—Great Wall. **Geil.**
The Great Wall of China. By William Edgar Geil. London: J. Murray, 1909. Size 9 × 6, pp. xviii. and 352. *Sketch-map, Plan, and Illustrations. Price* 21*s. net. Presented by the Publisher.*

China—Kiang-su. *M. Seminars Oriental. Sprachen* **12** (1909): 157–198. **Tschepe.**
Das chinesische Holland in Mittelchina. Eine geographisch-geschichtliche Studie von P. Albert Tschepe.

Dutch East Indies. *Ts. K. Nederlandsch Aard. Genoots.* **26** (1909): 723–746. ———
De staatkundige indeeling van Nederlandsch-Indie. *Map.*

Dutch East Indies—Survey. **Rouffaer.**
Ts. K. Nederlandsch. Aard. Genoots. **26** (1909): 773–788.
Een bezoek aan de Topographische Inrichting te Batavia. Door G. P. Rouffaer.

French Indo-China—Archæology. **Lunet de Lajonquière.**
B. Ecole française Extrême-Orient **9** (1909): 351–368.
Rapport sommaire sur une mission archéologique au Cambodge, au Siam, dans la presqu'île malaise et dans l'Inde (1907–1908). Par E. Lunet de Lajonquière.

French Indo-China—Cochin China. **Philipon and Rey.**
B.S.G. Rochefort **31** (1909): 125–156.
Relation du second voyage, à la Cochinchine, du navire Henri, armé à Bordeaux par M. Philipon, et commandé par M. le capitaine Rey, pendant l'année 1819 et les trois premiers mois de 1820.

India—Bengal—Ethnology. **Bompas.**
Folklore of the Santal Parganas. Translated by Cecil Henry Bompas. London: D. Nutt, 1909. Size 9 × 5½, pp. 484. *Price* 10*s.* 6*d. net. Presented by the Publisher.*

India—Himalaya. *A Travers le Monde* **15** (1909): 357–359. **Dupuy.**
L'Expedition du Duc des Abruzzes dans le Massif de l'Himalaya. Par E. Dupuy. *Sketch-map.*

India—Historical. **Fryer and Crooke.**
A new account of East India and Persia, being nine years' travels, 1672–1681. By John Fryer; edited . . . by William Crooke. Vol. I. (Works issued by the Hakluyt Society, Second Series, No. xix.) London, 1909. Size 9 × 5½, pp. xl. and 354. *Facsimile Maps and Illustrations. Presented by the Hakluyt Society.*

India—Rajputana. **Holland and Christie.**
Records Geol. Surv. India **38** (1909): 154–186.

The Origin of the Salt Deposits of Rajputana. By Sir Thomas H. Holland and W. A. K. Christie. *Sketch-map.*

Japan—Formosa. *Smithsonian Misc. Coll.* **52** (No. 1860: 1909): 287–294. **Arnold.**

The Peoples of Formosa. By Julean H. Arnold. *Map and Illustrations.*

The writer's ascent of Mount Morrison was referred to in the Monthly Record for December (p. 679).

North Central Asia. *M.G. Ges. Jena* **27** (1909): 1–127. **Paquet.**

Südsibirien und die Nordwestmongolei. Von Mr. Alfons Paquet. *Maps and Illustrations.*

Malay Archipelago—Borneo. **Baring-Gould and Bamfylde.**

A history of Sarawak under its two white Rajahs, 1839–1908. By S. Baring-Gould and C. A. Bamfylde. London: H. Sotheran & Co., 1909. Size 9 × 6, pp. xxiv. and 460. *Map and Illustrations. Price* 15*s. net. Presented by the Publishers.*

Malay Archipelago—Jilolo. **Jongh.**
Ts. K. Nederlandsch Aard. Genoots. **26** (1909): 747–772.

De Oostkust van Noord-Halmahera. Door G. J. J. de Jongh. *Sketch-maps.*

AFRICA.

Africa—Historical. *Mouvement G.* **26** (1909): 376–378. **Wauters.**

L'Afrique centrale a-t-elle été decouverte au XVI^e^ siècle? Par A.-J. Wauters. *Map.*

Exposes once more the fallacy of the supposed exploration of the African interior in the sixteenth century.

Algeria—Denudation. *Geographische Z.* **15** (1909): 493–510. **Passarge.**

Verwitterung und Abtragung in den Steppen und Wüsten Algeriens. Von Siegfried Passarge. *Illustrations.*

Angola. *K.A.W. Amsterdam. P. Sec. Sc.* **11** (1908): 88–109. **Sanders.**

Contributions to the determination of geographical positions on the west coast of Africa. III. By C. Sanders.

Belgian Congo. *Mouvement G.* **26** (1909): 397–406. **Prince Albert.**

La traversée du Congo Belge. Par le Prince Albert de Belgique. *Portrait and Sketch-maps.*

Belgian Congo—Ethnology. *B.S.R. Belge G.* **32** (1908): 386–421, 429–450. **Delhaise.**

Ethnographie congolaise: Chez les Warundi et les Wahorohoro. Par Charles Delhaise. *Illustrations.*

These tribes dwell round the north and west of Tanganyika.

Belgian Congo—Ethnology. **Hutereau.**

Annales du Musée du Congo: Ethnographie et Anthropologie. Series III. Documents Ethnographiques concernant les Populations du Congo Belge. Tome i. Fascicule i. Notes sur la vie familiale et juridique de quelques populations du Congo Belge. Par A. Hutereau. Brussels, 1909. Size 14½ × 10½, pp. 1–104 and i.–xii. *Maps and Illustrations.*

Canary Islands. **Brun.**

Le Chahorra (Iles Canaries). Par M. Albert Brun. (Extrait, l'Écho des Alpes, No. 10, Octobre, 1909.) Geneva, 1909. Size 9 × 5½, pp. 337–354. *Illustrations. Presented by the Author.*

The Chahorra is one of the subsidiary cones of the famous peak, the site of the eruption of 1798.

Canary Islands—Phytogeography. **Schenck.**

Beiträge zur Kenntnis der Vegetation der Canarischen Inseln. Von Dr. Schenck. (*W. Ergebnisse Valdivia-Expedition*, 1898–99 (*Chun*) **2** (1907): 1 Teil, 225–406.) *Maps and Illustrations.*

Canary Islands—Phytogeography. **Schröter.**

Eine Enkursion nach den canarischen Inseln. Von Dr. C. Schröter. Zürich: Rascher & Cie., [1909]. Size 9 × 6, pp. 66. *Illustrations. Price* 4*s.*

Cape Colony—Ground-level. *Trans. R.S. South Africa* I. (1909): 303–310. **Sutton.**

Preliminary note on the Diurnal Variation of Level at Kimberley. By J. R. Sutton.

Central Africa. **Mecklenburg.**

Ins innerste Afrika. Von Adolf Friedrich Herzog zu Mecklenburg. Bericht über den Verlauf der deutschen wissenschaftlichen Zentral-Afrika-Expedition 1907–1908. Leipzig: Klinkhardt und Biermann, 1909. Size 10 × 7, pp. xii. and 476. *Maps and Illustrations. Price* 14*m. Presented by the Publishers.*

Central Africa—Geodesy. *R. Engineers J.* **10** (1909): 209–220. **Jack.**

Measurement of the Semliki Base: with some notes on Invar Wires. By Captain E. M. Jack.

Central Africa—Phytogeography. **Mildbraed.**

Sitzb. K. Preuss. A.W. Berlin (1909): 989–1017.

Die Vegetationsverhältnisse der centralafrikanischen Seenzone vom Viktoria-See bis zu den Kiwu-Vulkanen. Bericht über die botanischen Ergebnisse der Expedition des Herzogs Adolf Friedrich zu Mecklenburg 1907–1908. Von J. Mildbraed.

East Africa. **MacQueen.**

In wildest Africa: the record of a hunting and exploration trip through Uganda, Victoria, Nyanza, the Kilimanjaro region, and British East Africa, with an account of an ascent of the snowfields of Mount Kibo, in East Central Africa, and a description of the various native tribes. By Peter MacQueen. Boston: L. C. Page & Co., 1909. Size 8 + 5½, pp. xiv. and 402. *Sketch-map and Illustrations. Presented by the Author.*

Egypt—Minerals. *Cairo Sc. J.* **3** (1909): 181–185. **Thomas.**

The Mineral Industry of Egypt. By A. E. Thomas. *Maps, Plan, and Sections.*

Egypt—Nile. *Cairo Sc. J.* **3** (1909): 209–213. **Dowson.**

A Consideration of the Magnitude of the Nile Flood in 1908. By E. M. Dowson. *Diagram.*

Egypt—Nile. **Dowson and Craig.**

Ministry of Finance, Egypt. Survey Department, Paper No. 11. Measurement of the Volumes discharged by the Nile during 1905 and 1906. By E. M. Dowson, with a note on Rating Formulæ for Current-meters, by J. I. Craig. Cairo, 1909. Size 10½ × 7, pp. 82. *Sketch-map, Plan, Diagrams, and Sections. Presented by the Director-General.*

Noticed in the Monthly Record (vol. **34**, p. 680).

Egypt—Roda Island. *B.S. Khédiviale G.* **7** (1909): 151–164. **Abbate.**

L'île de Rodah. Par Abbate Pacha. *Plans and Illustrations.*

Egypt—Sinai. *Cairo Sc. J.* **3** (1909): 155–161. **Weldon.**

Six Months in Northern Sinai. By L. B. Weldon. *Illustrations. Also separate copy*, size 10½ × 7, pp. 8.

Egypt—Surveys. *Cairo Sc. J.* **3** (1909): 218–224. **Crosthwaite.**

Survey Work in Lower Nubia, 1908-1909. By W. H. Crosthwaite.

Egypt—Surveys. ———

Ministry of Finance, Egypt. Survey Department. A Report on the Work of the Survey Department in 1908. Cairo, 1909. Size 10½ × 7, pp. 88. *Sketch-maps. Presented by Director-General.*

Egypt and Sudan—Evaporation. **Keeling.**

Ministry of Finance. Egypt. Survey Department, Paper No. 15. Evaporation in Egypt and the Sudan. By B. F. E. Keeling. Cairo, 1909. Size 10½ × 7½, pp. 30. *Presented by the Director-General.*

Eritrea. *L'esplarazione Com.* **24** (1909): 135–146, 164–176, 206–217, 235–245. **Odorizzi.**

La Dancalia italiana del Nord. Per D. Odorizzi.

French Congo. *B.S.G. Com. Havre* **25** (1908): 201–219; **26** (1909): 13–27. **Moll.**

Forêt et Savanes Congolaises. Par Commandant Moll.

French Guinea—Ethnology. **Guebhard.**

Rev. Études Ethnograph., Paris **2** (1909): 85–108.

Les Peulh du Fouta Dialon. Par Paul Guebhard. *Illustrations.*

French West Africa—Dahome. **Bartet.**

Les rois du Bas-Dahomey. Par Dr. A. Bartet. (Extrait du *Bulletin de la Société de Géographie de Rochefort*, 1908.) Rochefort, 1908. Size 10 × 6½, pp. 38. *Presented by the Author.*

German Colonies. **Meyer.**

Das Deutsche Kolonialreich. eine Länderkunde der deutschen Schutzgebiete . . . herausgegeben von Prof. Dr. Hans Meyer. I. Band: Ostafrika und Kamerun. Leipzig, etc., Bibliographische Institut, 1909. Size 10 × 7, pp. xii. and 650. *Maps and Illustrations. Price* 15*m. Presented by the Publishers.*

German Colonies—Agriculture. *Koloniale Z.* **9** (1908): 319–321. **[Kolbe.]**

Die Einführung der Pflugkultur in die Wirtschaft des Negers in Togo und Deutschostafrika. Von Oberleutnant a. D. F[ranz] Ko[lbe].

German East Africa. *Globus* **95** (1909): 309–312; 325–328. **Diesing.**

Eine Reise in Ukonongo (Deutsch-Ostafrika). Von Dr. Ernst Diesing.

German East Africa—Kilimanjaro. **Jaeger.**

Forschungen in den Hochregionen des Kilimandscharo. Von Dr. Fritz Jaeger. (Sonderabdruck aus *Mitteilungen aus den Deutschen Schutzgebieten*, Band xxii., 1909.) Berlin, 1909. Size 12½ × 9½, pp. 114–198. *Maps, Sections, and Illustrations. Presented by the Author.*

Dr. Jaeger's researches on Kilimanjaro were referred to in vol. **29**, p. 457.

German South-West Africa. *Deutsches Kolonialblatt* **20** (1909): 1004–1006. **Rappard.**

Durch die Namib nach Lüderitzbucht. Bericht des Hauptmanns v. Rappard. *Map.*

NORTH AMERICA.

Alaska. **Covert and Ellsworth.**

U.S. Geol. Surv., Water Supply Paper, **No. 228** (1909): pp. 108.

Water-Supply Investigations in the Yukon-Tanana Region, Alaska. 1907 and 1908. Fairbanks, Circle, and Rampart Districts. By C. C. Covert and C. E. Ellsworth. *Maps, Illustrations, and Diagrams.*

Alaska—Glaciers. *Z. Gletscherkunde* **3** (1908): 81–110. **Tarr.**

Some phenomena of the glacier margins in the Yakutat Bay region, Alaska. By Ralph S. Tarr. *Sketch-map and Illustrations.*

British Guiana. **Bayley.**

Handbook of British Guiana, 1909. Comprising general and statistical information concerning the colony. Edited and compiled by Geo. D. Bayley. Georgetown (London: Dulau & Co.), 1909. Size 8½ × 5½, pp. xxvi. and 608. *Map and Illustrations. Price* 5*s. Presented by the Publishers.*

Canada.

Department of the Interior. Report of the Chief Astronomer for the year ending March 31, 1907. Ottawa, 1908. Size 10 × 6½, pp. 258. *Illustrations and Diagrams.*

Appendices deal *inter alia* with gravity, magnetic, and latitude and longitude observations.

Mexico—Oaxaca. *J. Franklin I.* **168** (1909): 200–215. **Birkinbine.**

The Mixteca country in the State of Oaxaca, Mexico. By John Birkinbine. *Illustrations.*

Mexico—Tehuantepec. *B.S. Mexicana G.* **3** (1909): 165–179. **Castellanos.**

Breves apuntes sobre Geologia y Climatologia del Istmo de Tehuantepec. Por E. Maqueo Castellanos.

Mexico—Volcanoes. *Abrégé B.S. Hongroise G.* **36** (1908): 151–161. **Inkey.**

Des volcans du Méxique. Par B. de Inkey. *Illustrations.*

North America—Geology. *U.S. Geol. Surv., B.* **360** (1909): pp. 940. **Hise and Leith.**

Pre-Cambrian Geology of North America. By Charles Richard Van Hise and Charles Kenneth Leith. *Maps.*

United States—Colorado. **Fewkes.**

Bureau of American Ethnology. Bulletin 41. Antiquities of the Mesa Verde National Park. Spruce-tree House. By Jesse Walter Fewkes. Washington, 1909. Size 9 × 6, pp. 58. *Plan, Diagrams, and Illustrations.*

United States—Geodesy. **Hayford.**

[U.S.] Coast and Geodetic Survey. Geodesy. The Figure of the Earth and Isostasy from Measurement in the United States. By John F. Hayford. Washington, 1909. Size 11½ × 9, pp. 178. *Sketch-maps and Diagrams.*

United States—Magnetism. **Faris.**

Department of Commerce and Labor. Coast and Geodetic Survey. Terrestrial Magnetism. Results of Magnetic Observations made by the Coast and Geodetic Survey between July 1, 1907, and June 30, 1908. By R. L. Faris. Appendix No. 3. Report for 1908. Washington, 1909. Size 11½ × 8, pp. 71–166.

United States—Minerals. **Campbell and others.**

U.S. Geol. Survey, B. **341** and **380** (1909): pp. 444 and 406.

Contributions to Economic Geology, 1907. Part II. Coal and Lignite. By Marius R. Campbell. Ditto, 1908. Part I. Metals and Non-Metals, except Fuels. By C. W. Hayes and Waldemar Lindgren. *Maps, Plans, and Diagrams.*

United States—Minerals. *U.S. Geol. Surv., B.* **394** (1909): pp. 214. **Various authors.**

Papers on the conservation of Mineral Resources. By Various Authors. *Maps, Diagrams, and Illustration.*

United States—Minnesota. *American J. Sc.* **27** (1909): 388–392. **Griggs.**

Divided Lakes in Western Minnesota. By Robert F. Griggs. *Illustrations.*

Noticed in the January number, p. 81.

CENTRAL AND SOUTH AMERICA.

Andes. *American J. Sc.* **28** (1909): 197–217; 373–402. **Bowman.**

The Physiography of the Central Andes. Part I. The Maritime Andes; Part II. The Eastern Andes. By Isaiah Bowman. *Sketch-maps, Diagrams, and Illustrations.*

Argentina—Antiquities. **Willenius.**

Observaciones Arqueológicas sobre Alfareria Funeraria de la "Poma" (Valle Calchaqui—Provincia de Salta). Por J. A. Willenius. (De la Revista de la Universidad, tomo xi.) Buenos Aires, 1909. Size 10½ × 7, pp. 42. *Illustrations. Presented by the Author.*

Argentine—Archæology. **Quevedo.**

Tipos de Alfareria en la región Diaguito-Calchaqui. Por Samuel A. Lafone Quevedo. ('De la Revista del Museo de La Plata,' tomo xv. (segunda serie, tomo ii.), páginas 295 á 396.) Buenos Aires, 1908. Size 11 × 7½, pp. 295–396. *Sketch-maps and Illustrations. Presented by the Author.*

Argentine—Ethnology. **Quevedo.**

Etnologia Argentina. Por Samuel A. Lafone Quevedo. ('De la Universidad Nacional de La Plata en el IV° Congreso Científico (1° Panamericano),' páginas 176 á 215.) Buenos Aires, 1909. Size 11 × 7½, pp. 176–216. *Map. Presented by the Author.*

Bolivia—Anthropogeography. *B.G.S. Philadelphia* **7** (1909): 159–184. **Bowman.**

The Highland Dweller of Bolivia: an Anthropogeographic Interpretation. By Isaiah Bowman. *Illustrations.*

Bolivia—Economics.

Cuestiones Económicas y Financieras. (Articulos publicados en la revista ministerial de Hacienda é Industria.) La Paz, 1909. Size 9 × 6, pp. 222.

Brazil. *Sitzb. A.W. Wien* **116** (Abt. I.) (1907): 1111–1204. **Schuster and others.**

Petrographische Ergebnisse der brasilianischen Expedition 1901 der kais. Akademie der Wissenschaften. Von Dr. Karl Schuster. Mit einer geologischen Einleitung von Dr. Fritz v. Kerner und Bemerkungen über die Kristallinen Schiefer von F. Becke. *Sketch-maps.*

Some account of this expedition, organised primarily for botanical research in the mountain ranges of south-eastern Brazil, was given in the *Journal*, vol. **17**, p. 195; vol. **18**, p. 625.

Cuba—Demography. **Heape.**

The Proportion of the Sexes produced by Whites and Coloured Peoples in Cuba. By Walter Heape. (From the *Philosophical Transactions of the Royal Society of*

London, Ser. B, vol. **200**.) London, 1909. Size 12 × 9,' pp. 271–330. *Presented by the Author.*

West Indies—Cotton. **Watts.**

The British Cotton-growing Association. No. 35. West Indian Cotton Growing. By the Hon. Francis Watts. Manchester, 1909. Size 8½ × 5½, pp. 20. *Sketch-map.*

AUSTRALASIA AND PACIFIC ISLANDS.

Queensland—Exploration. *P.R.S. Queensland* **22** (1909): 1–22. **Norton.**

The Jardines' Expedition from Rockhampton to Cape York in 1864. By Hon. A. Norton.

Southern Ocean—Bouvet Island. **Sachse.**

Das Wiederauffinden der Bouvet-Insel durch die deutsche Tiefsee-Expedition. Von Kapt. W. Sachse. (*W. Ergebnisse "Valdivia" Expedition*, 1898–99 (*Chun*) **10** (1905): 1–34.) *Maps and Illustrations.*

Southern Ocean—Islands. **Reinisch.**

Gesteine von der Bouvet-Insel, von Kerguelen, St. Paul und Neu-Amsterdam. Von R. Reinisch. (*W. Ergebnisse "Valdivia"-Expedition*, 1898–99 (*Chun*) **10** (1908): 45–76.) *Illustrations.*

Southern Ocean—Islands. **Schenck.**

Vergleichende Darstellung der Pflanzengeographie der subantarktischen Inseln, insbesondere über Flora und Vegetation von Kerguelen. Von H. Schenck. (*W. Ergebnisse "Valdivia"-Expedition*, 1898–99 (*Chun*) **2** (1905): 1 Teil. 1–178.) *Map and Illustrations.*

Southern Ocean—St. Paul and New Amsterdam. **Schenck.**

Ueber Flora und Vegetation von St. Paul und Neu-Amsterdam. Von H. Schenck. (*W. Ergebnisse "Valdivia"-Expedition*, 1898–99 (*Chun*) **2** (1905): 1 Teil, 179–224.) *Illustrations.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geomorphology. *Z. Gletscherkunde* **3** (1909): 346–358. **Werth.**

Fjorde, Fjärde und Föhrden. Von Dr. Emil Werth. *Section and Illustrations.*

Geophysics. *J. Geology* **17** (1909): 344–350. **Gilbert.**

The Convexity of Hilltops. By G. K. Gilbert. *Diagram and Illustrations.*

Glacial Epoch. **Nölke.**

Neue Erklärung der Entstehung der irdischen Eiszeiten. Von Dr. Fr. Nölke. (Sonder-Abdruck aus den Abh. d. Nat. Ver. Bremen, Bd. xx., Heft 1.) Bremen, 1909. Size 9 × 5½, pp. 28.

Glacier Streams. *Z. Gletscherkunde* **3** (1909): 271–285. **Gogarten.**

Messungen der Schlammführung von Gletscherbächen. Von E. Gogarten. *Diagram.*

Kumatology. *Quart. J. R. Met. S.* **85** (1909): 149–161. **Cornish.**

Wind-waves in Water, Sand, Snow, and Cloud. By Dr. Vaughan Cornish. *Illustrations.*

Lakes and Climate. *Naturw. Wochenschrift* **8** (1909): 385–393. **Halbfass.**

Temperaturmessungen in tiefen Seen in ihrer Beziehung zur Klimatologie. Von Prof. Dr. Halbfass. *Diagrams.*

Meteorology. *B.A. Imp. Sc. St. Petersbourg* (1909): 745–764. **Rykachef.**

Observations faites dans les différentes couches de l'atmosphère durant le voyage de St. Petersbourg à Odessa à bord du bateau *Neptune* de la Compagnie Russe de Navigation et Commerce depuis le 9 (22) mai jusqu'au 30 mai (12 juin) 1908. Par M. M. Rykacev. *Diagrams.* [In Russian.]

Meteorology. *C.R.A. Sc. Paris* **148** (1909): 591–594. **Teisserenc de Bort.**

Lois de distribution de la température avec la hauteur aux diverses latitudes, et suivant les régimes météorologiques différents. Par L. Teisserenc de Bort. *Diagrams.*

Meteorology—Cloudiness. *Met. Z.* **26** (1909): 49–54, 201–209. **Steen.**

Einige Studien über die Bewolkung. I.–III. Von Aksel S. Steen. *Diagrams.*

Meteorology—Historical. **Hoffmann.**
Münchener G. Studien (*Günther*) **22** (1907): pp. 96.
Die Anschauungen der Kirchenväter über Meteorologie: ein Beitrag zur Geschichte der Meteorologie. Von Immanuel Hoffmann.

Meteorology—Upper air. **Gold and Harwood.**
The Present State of our Knowledge of the Upper Atmosphere as obtained by the use of Kites, Balloons, and Pilot Balloons. Report of the Committee, consisting of Messrs. E. Gold and W. A. Harwood. (British Association, Section A, Winnipeg, 1909.) [London, 1909.] Size 8½ × 5½, pp. 54. *Diagrams.*

Meteorology—Upper air. *Met. Z.* **26** (1909): 241–258. **Schmauss.**
Die obere Inversion. Von A. Schmauss. *Diagrams.*

Meteorology—Water-circulation. *Quart. J.R. Met. S.* **35** (1909): 189–211. **Latham.**
Percolation, Evaporation, and Condensation. By Baldwin Latham. *Diagrams.*

Oceanography—Baltic. **Abshagen.**
XI. Jbericht G. Ges. Greifswald, 1907–08 (1909): 61–160.
Das Phytoplankton des Greifswalder Boddens. Von Gustav Abshagen. *Chart and Diagrams.*

Oceanography—Currents. *Ann. Hydrographie* **37** (1909): 254–261. **Schiötz.**
Zur Frage der durch den Wind erzeugten Meeresstromungen. Von O. E. Schiötz.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Agriculture. *Travel and Exploration* **2** (1909): 139–143. **Fairchild.**
A New Exploration of the World. By David Fairchild.
An account of agricultural exploration under the U.S. Department of Agriculture.

Anthropogeography. *B. American G.S.* **41** (1909): 537–566. **Jefferson.**
The Anthropogeography of some Great Cities. A Study in Distribution of Population. By Mark Jefferson. Size 9½ × 6, pp. 537–566. *Plans. Also separate copy.*

Commercial—Cables. *Deutsche Rundschau G.* **32** (1909): 34–35. **Webersik.**
Das Kabelnetz der Erde und der überseeische Nachrichtenverkehr im Jahre 1909. Von Gottlieb Webersik. *Map.*

Commercial—Oil Palm. *Kew B.* (1909): 161–184. ——
The Economic Aspects of the Oil Palm.

Commercial—Timber. *B. Bureau American Republics* **29** (1909): 538–560. ——
The Hard Woods of the Americas—Quebracho. *Illustrations.*

Commercial Geography. **Dubois and Kergomard.**
Précis de géographie économique. Par Marcel Dubois et J.-G. Kergomard; avec la collaboration de Louis Laffitte. 3e édit. Paris: Masson et Cie., 1909. Size 9 × 5½, pp. xvi. and 864. *Presented by M. Marcel Dubois.*

Disease. **Boyce.**
Mosquito or Man? The conquest of the tropical world. London: J. Murray, 1909. Size 9 × 6, pp. xvi. and 268. *Illustrations. Price* 10*s.* 6*d. net. Presented by the Publisher.*

Economic Geography. **Robinson.**
Economic Geography. An Attempt to state What it is and What it is not. By Edward Van Dyke Robinson. (Reprinted from *Publications of the American Economic Association*, vol. **10**, No. 1, April, 1909.) Minnesota, 1909. Size 9 × 6, pp. 12.

GENERAL.

British Empire. **Jose.**
The growth of the Empire: a handbook to the history of Greater Britain. By Arthur W. Jose. Revised edition. London: J. Murray, 1909. Size 8 × 5, pp. xvi. and 444. *Maps. Price* 4*s.* 6*d. Presented by the Publisher.*

Education. *J.G.* **8** (1909): 1–9. **Chamberlain.**
Report of the Committee on Secondary School Geography. By James F. Chamberlain.

Education. **Lyde.**

The teaching of geography. By L. W. Lyde. London: Blackie & Son, 1909. Size 6½ × 4½, pp. 120. *Price* 1*s. net. Presented by the Author.*

Oceanic Islands. **Nicoll.**

Three voyages of a naturalist; being an account of many little-known islands in three oceans visited by the *Valhalla*, R.Y.S. By M. J. Nicoll. Second edition. London: Witherby & Co., 1909. Size 9 × 6, pp. xxx. and 246. *Sketch-maps and Illustrations. Price 7s. 6d. net. Presented by the Publishers.*

The first edition was reviewed in vol. **32**, p. 81.

Place-names. *B.S. Khédiviale G.* **7** (1909): 185–195. **Galante.**

Quelques observations sur la déformation de la transcription des noms géographiques du monde musulman. Par Abraham Galante.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Austria. **Kober, Freytag, and Berndt.**

Schulwandkarte des Herzogtums Schlesien. Bearbeitet von Rudolf Kober. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. 4 sheets. Vienna: G. Freytag & Berndt, 1909. *Price, mounted on rollers, 30kr.*

Schulwandkarte des politischen Bezirkes Horn. Scale 1 : 40,000 or 1·6 inch to 1 stat. mile. 4 sheets. Vienna: G. Freytag & Berndt, 1909. *Price, mounted on rollers, 36kr.*

Karte der politischen Bezirke Melk und Scheibbs. Scale 1 : 200,000 or 1 inch to 3·2 stat. miles. Karte der Bezirke Wiener-Neustadt und Neunkirchen. Scale 1 : 150,000 or 1 inch to 2·4 stat. miles. Vienna: G. Freytag & Berndt, [1909]. *Price* 30 *Heller each. Presented by the Publisher.*

These are all school maps showing relief by hill-shading and contours, combined with colour tinting on what has been called the stereoscopic or prismatic principle, the tints ranging from red and reddish-brown for the highest lands to bluish-greens for the lowlands, as described in the *Geographical Journal* for June, 1907. The effect, specially in the case of the smaller scale maps, is decidedly good, and the relief is shown at a glance in a graphic manner. The small map of the Melk and Scheibbs districts is certainly an excellent example of this method of showing relief. In the case of the larger scale wall maps the green is hardly satisfactory, and the change between this and the browns is too abrupt.

Austria. **Freytag and Gragger.**

G. Freytag's Schi-Routenkarte der Niederösterreichisch-Steirischen Kalkalpen. Bearbeitet von Hans Gragger. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. G. Freytag's Schi-Routenkarte des Oberen Ennstales und der Rottenmanner Tauern. Bearbeitet von Hans Gragger. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Vienna: G. Freytag & Berndt, [1910]. *Price* 2.0*kr. each. Presented by the Publisher.*

Austria. **Rothaug.**

Karte der österreichischen Alpenländer. Bearbeitet von J. G. Rothaug. Scale 1 : 1,500,000 or 1 inch to 23·6 stat. miles. Vienna: G. Freytag & Berndt, [1909]. *Presented by the Publisher.*

Austria-Hungary. **Hickmann.**

Prof. A. L. Hickmann's Geographisch-Statistischer Taschen-Atlas von Österreich-Ungarn. 3. Vollständig neu bearbeitete Auflage. Vienna and Leipzig: G. Freytag & Berndt, [1910]. *Presented by the Publisher.*

The third edition of a small pocket atlas, similar in form and style of production to the Universal-Taschen Atlas by the same author. Apart from the maps of Austria-Hungary, which for their scale are good and clear, a vast amount of statistical information connected with the empire is given by graphic diagrams and in tabular form.

Austria-Hungary. **Freytag.**

G. Freytag's Verkehrskarte von Österreich-Ungarn mit den Balkanländern. Scale

1 : 1,500,000 or 1 inch to 23·6 stat. miles. Vienna and Leipzig : G. Freytag & Berndt, 1910. *Price* 2.40*kr.* *Presented by the Publisher.*

Belgium. **Deventer.**

Atlas des Villes de la Belgique au XVI^e^ Siècle. Cent Plans du Geographe Jacques de Deventer exécutés sur les ordres de Charles-Quint et de Philippe II. reproduits en facsimilé chromographique par l'Institut Nacional de Géographie à Bruxelles. Publication commencée par Ch. Ruelens et continuée sous la direction de Em. Ouverleaux et J. van den Ghenyn, S.J. 17^e^ Livraison. Brussels : M. Weissenbruch ; Falk Fils, 1909.

A continuation of the atlas noticed in the *Geographical Journal* for August last. This part contains plans of Cassel, Dunkerque, Halluin-Menin, and Venloo.

Belgium. **Ministère des Chemins de Fer, Postes et Telegraphes.**

Carte Officielle des Chemins de Fer de la Belgique au 31 Décembre 1908. Scale 1 : 400,000 or 1 inch to 5·4 stat. miles. Brussels : Institut Cartographique Militaire, 1909. *Presented by the Military Cartographical Institute, Brussels.*

British Isles—Dublin. **Bartholomew.**

Plan of Dublin. Scale 1 : 19,500 or 3·2 inches to 1 stat. mile. Edinburgh : John Bartholomew & Co., 1910. *Price* 1*s. net., mounted on cloth.* *Presented by the Publishers.*

British Isles—England. **Feigerl.**

Contour relief models of the country north and south of London. Prepared from the Ordnance Survey by G. R. C. Feigerl. Horizontal scale 1 : 126,720 or 1 inch to 2 stat. miles ; vertical scale 1 : 21,120 or 3 inches to 1 stat. mile. London : Sifton & Praed, 1909. *Price* £2 5*s. each.*

These two are the first to be published of what promises to be a most useful set of relief maps of various districts of England. They consist of sheets of the new orographically coloured Ordnance Survey maps on the scale of 2 miles to 1 inch, mounted upon carefully executed relief models, of which the vertical scale is exaggerated six times. This exaggeration is perhaps too great, and the result would have been more satisfactory if it had been only about half this amount ; but bearing this difference of scale in mind, a good idea of the relief of the London basin from the Chilterns to beyond the North Downs is conveyed by the models The orographical colouring adds considerably to their success and graphic effect, and on the whole the publishers may be congratulated on their attempt. The mounting of the maps on the models has been a most difficult matter, and it is not surprising that somewhat unsightly joins in the paper are occasionally noticeable ; but with more experience improvements will doubtless be made in this respect. It is understood that other relief maps of the kind are in hand, one of which is the district to the south of the area now covered, which will include the South Downs and extend to the south coast.

British Isles—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from January 1 to 31, 1910.

1-inch—(third edition) :—

Engraved in outline, 131. *Price* 1*s.*

6-inch—County Maps :—

Cheshire, 2 sheets. **Hampshire,** 4 sheets. **Kent,** 15 sheets. **Lancashire,** 1 sheet. **Sussex,** 1 sheet. **Yorkshire,** 8 sheets. *Price* 1*s. each.*

25-inch—County Maps :—

Cheshire, 25 sheets. **Hampshire,** 19 sheets. **Lancashire,** 8 sheets. **Sussex,** 50 sheets. **Yorkshire,** 36 sheets. *Price* 3*s. each.*

(*E. Stanford, London Agent.*)

British Isles—London. **Bartholomew.**

Bartholomew's contoured map of the Environs of London. Scale 1 : 63,360 or 1 inch to 1 stat. mile. New edition. Edinburgh : John Bartholomew & Co., 1910. *Price* 2*s., mounted on cloth.* *Presented by the Publisher.*

British Isles—Thames Basin. **Johnston.**

The Basin of the Thames. Scale 1 : 190,080 or 1 inch to 3 stat. miles. 2 sheets. Edinburgh and London : W. & A. K. Johnston, 1910. *Price, in sheets,* 9*s.* *Presented by the Publisher.*

An orographically tinted school wall-map of the basin of the Thames in seven

shades of reddish-brown, increasing in density with the altitude. The names of valleys, ranges, rivers, and other physical features are given in accordance with the recent arrangement, as shown on the map published in the *Geographical Journal* for December, 1904. These are the only names, those of the principal towns being merely indicated by the initial letter, so that the map is not in the least overcrowded. Railway lines and ancient roads are shown in red, and the controlling influence of the physical features upon the direction these follow is clearly brought out. There is much to commend the map for educational purposes, although there may be room for improvement in the tints used for showing the relief. At present there is hardly sufficient difference between several of them to give an altogether satisfactory effect. An edition of the map can be obtained without names.

Europe.

Befestigungen der österreichisch-italianischen Grenze. Scale 1 : 450,000 or 1 inch to 7·1 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 20. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Europe. **Alt.**

Geographische Verteilung der Gewitter-Häufigkeit in Kontinental- und Nord-europa. Von Dr. E. Alt. Scale 1 : 20,000,000 or 1 inch to 315·6 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 1. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

France. **Service Géographique de l'Armée, Paris.**

Carte de France. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheets: xxvi.–11, Soissons: xxxvii. 42, Menton. Paris: Service Géographique de l'Armée, 1909. *Price* 1.60 *fr. each sheet.*

Russia. **Kawkaski.**

Die Befestigungen in Russisch-Polen. [Von F. Kawkaski.] Scale 1 : 1,500,000 or 1 inch to 23·6 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 12. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

ASIA.

Armenia. **Oswald.**

Tektonische Uebersichtskarte Armeniens. Von Dr. Felix Oswald. Scale 1 : 2,340,000 or 1 inch to 36·9 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 2. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Based on the Dr. Oswald's geological map noticed in the *Geographical Journal* for December, 1907.

Central Asia. **Prinz.**

Uebersicht der Reisewege von Dr. Gyula Prinz in Mittelasien 1909. Scale 1 : 2,500,000 or 1 inch to 39·4 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 13. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Java. **Topographical Bureau, Batavia.**

Topographische Kaart van Java en Madoera. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: ii., iii., iv. and viii., vi., vii., x. Residentie Banjoemas; xi., xii., xiv., xv., Residentrien Banjoemas en Kedoe; xvi. Residentie Kedoe; xvii. Residentie Semarang. Batavia: Topographical Bureau, 1901–09.

These are the first published sheets of the new Government survey of Java and Madura which has been in progress for some years. According to a general map issued as an index, when complete there will be altogether about one hundred and fifty sheets, each measuring 19 inches by 15 inches. They are most creditably produced and printed in colours. Heights are shown by brown contours and figures, roads in red, vegetation and plantations green, and water blue. According to a note on the index map, the survey has been plotted on two different projections, the western half being on Bonne's, and the eastern on a form of polyhedral projection.

Sumatra. **Topographical Bureau, Batavia.**

Overzichtskaart van het eiland Sumatra. Scale 1 : 2,000,000 or 1 inch to 31·5 stat. miles. Batavia: Topographical Bureau, 1908.

AFRICA.

Africa. **Bartholomew.**

Central and South Africa. By J. G. Bartholomew, F.R.G.S. Scale 1 : 5,000,000 or 1 inch to 78·9 stat. miles. Edinburgh: John Bartholomew & Co., 1910. *Price* 3*s.*, *mounted on cloth. Presented by the Publisher.*

On the present edition of this well-known and useful general map the boundaries

and railways have been corrected to date. It is difficult to understand why hill shading is shown only on the southern part of the map, and it certainly would be an advantage if it could be completed on another edition.

British East Africa. **Geographical Section, General Staff.**

British East Africa, Uasin Gishu Plateau. Scale 1 : 62,500 or 1·011 inch to 1 stat. mile. Sheets 3, 4, and 5. London: Geographical Section, General Staff, War Office, 1909. *Price 1s. 6d. each sheet. Presented by the Director of Military Operations.*

Egypt. **Survey Department, Cairo.**

Topographical map of Egypt. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheets: N.W. V.–I., Kafr el Zayat; VI.–I., Kafr el Sheikh; VII.–I., Shalma; VIII.–I., Lake Borollos east; VIII.–II., Lake Borollos west; VIII.–III., Rosetta; S.E. XXVIII.–IX., Kom Ombo east; XXXI.–VIII., Dabod; XXXII.–VIII., Dehmil; XXXIII.–VIII., Kalabsha. Cairo: Survey Department, 1909. *Presented by the Director-General, Survey Department, Cairo.*

German South-West Africa. **Quelle.**

Diamant-Fundstellen in Deutsch-Südwestafrika nach dem gegenwärtigen Stande der Kenntnis. [Von Dr. O. Quelle.] Scale 1 : 1,500,000 or 1 inch to 23·6 stat. miles. Diamant-Bergbaufelder bei Lüderitzbucht und Pomona. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 5. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Ivory Coast. **Meunier.**

Carte de la Côte d'Ivoire. Dressée par A. Meunier. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. Sheets: 3, Séquéla; 4, Kouadiokofi; 5, Sassandra; 6, Bingerville. Paris: Ministère des Colonies, Service Géographique et des Missions, 1905.

Northern Nigeria. **Geographical Section, General Staff.**

Northern Nigeria. Scale 1 : 2,000,000 or 1 inch to 31·5 stat. miles. London: Geographical Section, General Staff, War Office, 1909. *Price 3s. Presented by the Director of Military Operations.*

This map can be obtained in two styles, with and without orographical tinting.

Sahara-Sudan. **Marquardsen.**

Das Saharisch-Sudanische abflusslose Gebiet von H. Marquardsen. Scale 1 : 6,000,000 or 1 inch to 94·7 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 4. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

This map extends in latitude from 4° to 6° N., and in longitude from 6° to 24° E. It thus includes the Lake Chad and Shari basin, together with the Tibesti mountains, Fezzan, Wadai, and the greater part of Northern Nigeria. Relief is indicated by orographical tinting in eleven shades of colour; but considering how little is known of many parts of this vast region, this is a bold attempt, and can only serve to give a very approximate idea of relative altitude. The map accompanies the paper by Dr. H. Marquardsen in the January number of *Petermanns Geograph. Mitteilungen* for the present year.

Sudan. **Kumm.**

Uebersicht von Dr. K. Kumms Durchquerung von Afrika durch den Sudan. Scale 1 : 7,500,000 or 1 inch to 118·3 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 17. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Tunis. **Service Géographique de l'Armée, Paris.**

Carte de la Tunisie. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheet cviii. Foum Tataouine. Paris: Service Géographique de l'Armée, [1909]. *Price 1.20 fr. each sheet.*

AMERICA.

Canada—Saskatchewan. **Dept. of Public Works, Saskatchewan.**

Map of the southern part of the Province of Saskatchewan. Scale 1 : 633,600 or 1 inch to 10 stat. miles. Corrected to October 1, 1909. 2 sheets. Regina: Department of Public Works, 1909. *Presented by the Commissioner of Public Works, Regina, Saskatchewan.*

Patagonia. **Krüger.**

Das Andine Gebiet Patagoniens zwischen 40° und 44° S. Nach den Arbeiten der chilenischen und argentinischen Grenzkommissionen und eigenen Aufnahmen entworfen und gezeichnet von Prof. Dr. Paul Krüger. Scale 1 : 500,000 or 1 inch

to 7·8 stat. miles. *Petermanns Mitteilungen*, Erganzungsheft 164. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Peru and Bolivia.

Endgiltige Linienführung der neuen Grenze zwischen Peru und Bolivien. Scale 1: 2,000,000 or 1 inch to 31·5 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 18. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

Peru and Ecuador. **Sievers.**

Uebersicht von Wilhelm Sievers' Reisen in Peru und Ecuador 1909. Scale 1: 7,500,000 or 1 inch to 118·4 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 6. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

AUSTRALASIA.

Australasia. **Robinson.**

"The Lady Northcote" Atlas of Australasia. By H. E. C. Robinson. With an historical introduction on the discovery and exploration of Australia by Charles R. Long, M.A. Geological notes by Leo. A. Cotton, B.A., B.SC., and an alphabetical index to places on the maps. Sydney: H. E. C. Robinson, 1908.

An atlas of eighteen plates of maps and plans, specially prepared for use in Australian schools and colleges and commercial establishments, under the auspices and support of Lady Northcote. In addition to the general maps of the continent and special maps of its various states, Tasmania, and New Zealand, there are maps of the world showing British possessions and spheres of influence, the principal Australian trade routes, meteorological, orographical, and geological maps, and ten historical diagrams, showing the division of Australia from 1787 to 1908. An interesting feature is the short and concise chapter on the discovery and exploration of Australia by C. R. Long, M.A. As specimens of cartography the maps are poor productions, but as a whole the atlas contains a considerable amount of useful information brought together by Australians from an Australian standpoint.

New Guinea. **Hemel and Reiber.**

Das Toricelli-Gerbirge (Kaiser Wilhelm-Land) und das ihm vorgelagerte Hügelland. Terrainaufnahmen von P. Const. v. d. Hemel, Geolog. Aufnahmen von P. Josef Reiber, 1907. Scale 1: 200,000 or 1 inch to 3·2 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, Tafel 16. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

New South Wales. **Robinson.**

Map of New South Wales showing Shires and Municipalities. By H. E. C. Robinson. 2 sheets. Scale 1: 1,013,760 or 1 inch to 16 stat. miles. Sydney: H. E. C. Robinson, [1909].

A bold but somewhat roughly executed map, in two sheets, measuring 38 × 54 inches, showing shires and municipalities in red. A small inset map of New South Wales is given in the south-east corner, through which a vertical section along each degree parallel of latitude is drawn. The purpose of these sections is doubtless to give an idea of the general relief of the country, but for this purpose an orographically tinted map would perhaps have served better.

GENERAL.

World. **Hickmann.**

Prof. A. L. Hickmann's Geographisch-Statistischen Universal-Taschen-Atlas. Vienna and Leipzig: G. Freytag & Berndt, 1910. *Presented by the Publisher.*

This is practically a reprint of the edition published last year.

World. **Johnston.**

The World-Wide Atlas of Modern Geography. Political and Physical, containing one hundred and twenty-eight plates and complete index, with an Introduction by J. Scott Keltie, LL.D., etc. Seventh edition (revised). Edinburgh and London: W. & A. K. Johnston, Ltd., 1910. *Price 7s. 6d. Presented by the Publisher.*

A new edition of this well-known atlas. Although useful for general reference and handy in size, the maps are somewhat rough productions, and many of them not over-clear.

World. **Kiepert.**

Henerici Kiepert. Formae Orbis Antiqui. 36 Karten mit kritischem Text und Quellenangabe zu jeder Karte. No. viii. Asia Minor imperatoris Traiani tempore.

Mit 20 Seiten Text. Bearbeitet und herausgegeben von Richard Kiepert. Berlin: Dietrich Reimer (Ernst Vohsen), 1910. *Price 3m. each sheet.*

An important sheet of this valuable atlas, showing Asia Minor at the time of the Emperor Trajan. The map has been prepared from the best available sources, and indicates clearly the leading physical features, as well as the political divisions, cities, and towns, roads, and other interesting information connected with the period dealt with. It is accompanied by twenty pages of text giving a very complete geographical account of the region and its then existing provinces, together with a full list of the authorities consulted.

World. **Rothaug.**

Geographischer Volksschul-Atlas für vier-bis sechsklassige Volksschulen-Ausgabe für Nieder-Österreich mit Erganzung für Wien. Bearbeitet von Joh. Georg Rothaug. Vienna: G. Freytag & Berndt, 1909. *Price 1.50 kr.*

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during December, 1909. *Presented by the Hydrographer, Admiralty.*

New Charts—No. 3739, Scotland, west coast: Upper part of Loch Long and Loch Goil, 2*s.* 975, United States, Gulf of Mexico: Approaches to Sabine pass, 3*s.* 3752, Red Sea. Gulf of Suez: Gimsah and Kabreit anchorages and approaches, 2*s.* 3730, Plans on the south coast of Ceylon: Weligama bay, Hambantota, 2*s.* **New Plans and Plans added**—No. 3618, Vancouver island. Moresby passage to Gabriola pass: Plan added: Boat harbour, 3*s.* 1962, China, south coast. Hong Kong to the Brothers: New Plan: Tai Sami, 4*s.* 2659, Solomon islands. Plan added: Mboli harbour, 1*s.* 6*d.* 1730, Samoa or Navigator islands. Plans added: Asaua harbour, Satupaitea road, Vatia anchorage, 3*s.*

Atlantic, North. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic Ocean, January, 1910. Washington: U.S. Hydrographic Office, 1910. *Presented by the U.S. Hydrographic Office.*

Atlantic, North. **U.S. Weather Bureau.**

Meteorological chart of the North Atlantic Ocean, March, 1910. Washington: Department of Agriculture, U.S. Weather Bureau, 1910. *Presented by the U.S. Weather Bureau.*

Atlantic, North, and Mediterranean. **Meteorological Office.**

Monthly meteorological charts of the North Atlantic and Mediterranean, February, 1910. London: Meteorological Office, 1910. *Price 6d. each. Presented by the Meteorological Office.*

Atlantic, South. **U.S. Weather Bureau.**

Meteorological chart of the South Atlantic Ocean, Season—March, April, May. 1910. Washington: Department of Agriculture, U.S. Weather Bureau, 1910. *Presented by the U.S. Weather Bureau.*

Indian Ocean and Red Sea. **Meteorological Office.**

Monthly meteorological charts of the Indian Ocean north of 15° S. lat. and Red Sea, February, 1910. London: Meteorological Office, 1910. *Price 6d. each. Presented by the Meteorological Office.*

Pacific, North. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, February, 1910. Washington: U.S. Hydrographic Office, 1910. *Presented by the U.S. Hydrographic Office.*

Pacific, North. **U.S. Weather Bureau.**

Meteorological chart of the North Pacific Ocean, March, 1910. Washington: Department of Agriculture, U.S. Weather Bureau, 1910. *Presented by the U.S. Weather Bureau.*

Pacific, South. **U.S. Weather Bureau.**

Meteorological chart of the South Pacific Ocean, Season—March, April, May, 1910. Washington: Department of Agriculture, U.S. Weather Bureau, 1910. *Presented by the Weather Bureau.*

PHOTOGRAPHS.

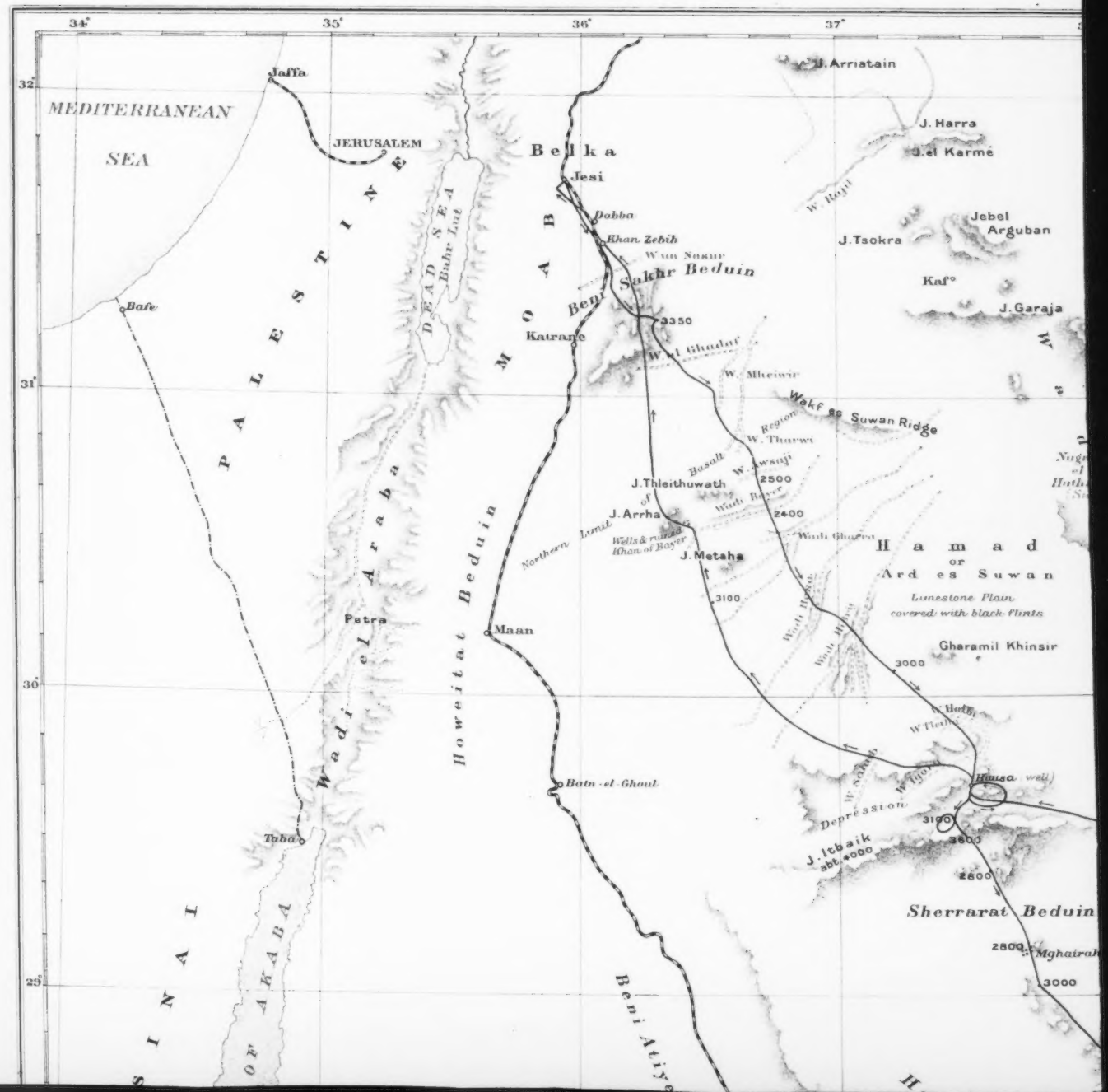
Kashmir. **Workman.**

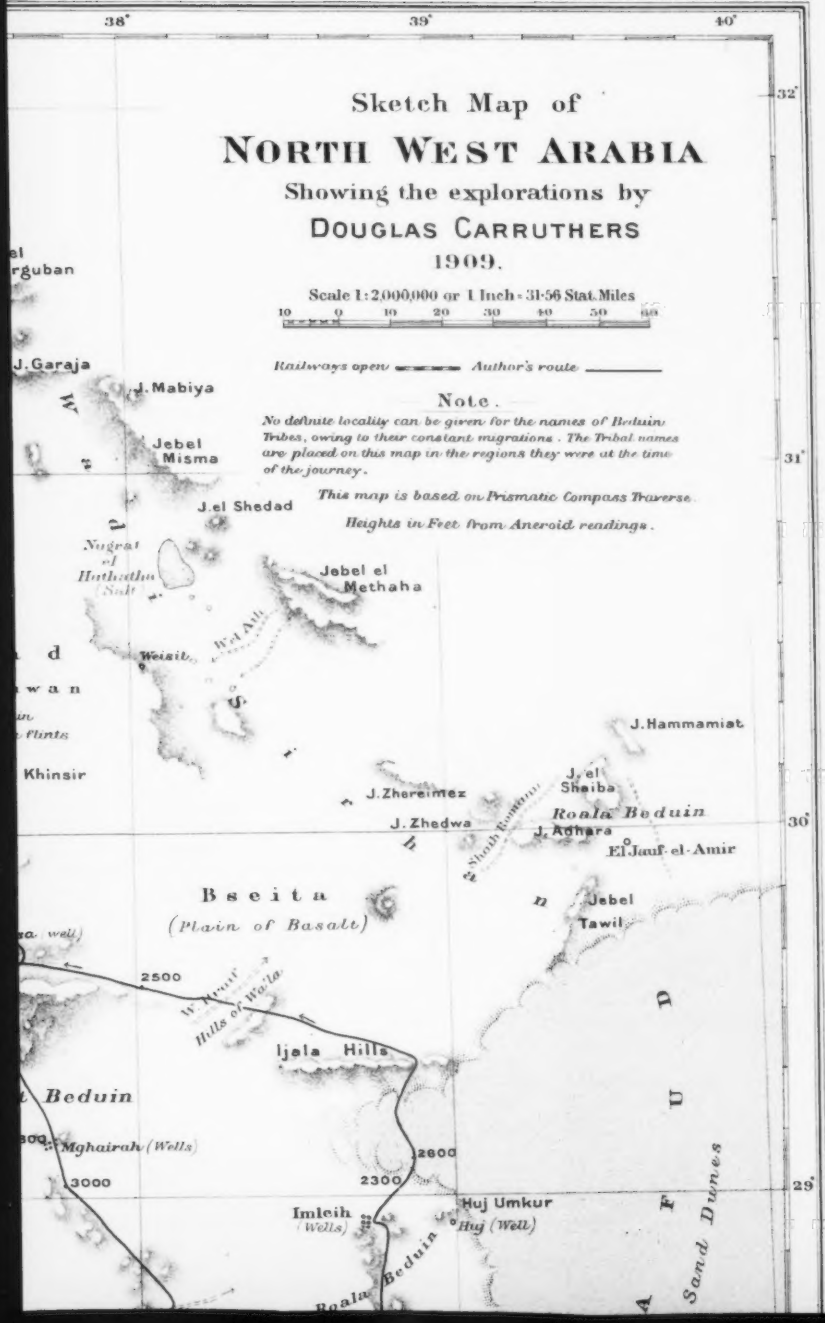
Ninety-two reproductions from photographs taken on the Bullock-Workman Expedition of 1906 to the Nun Kun, Kashmir. *Presented by Dr. W. H. Workman and Mrs. Fanny Bullock Workman.*

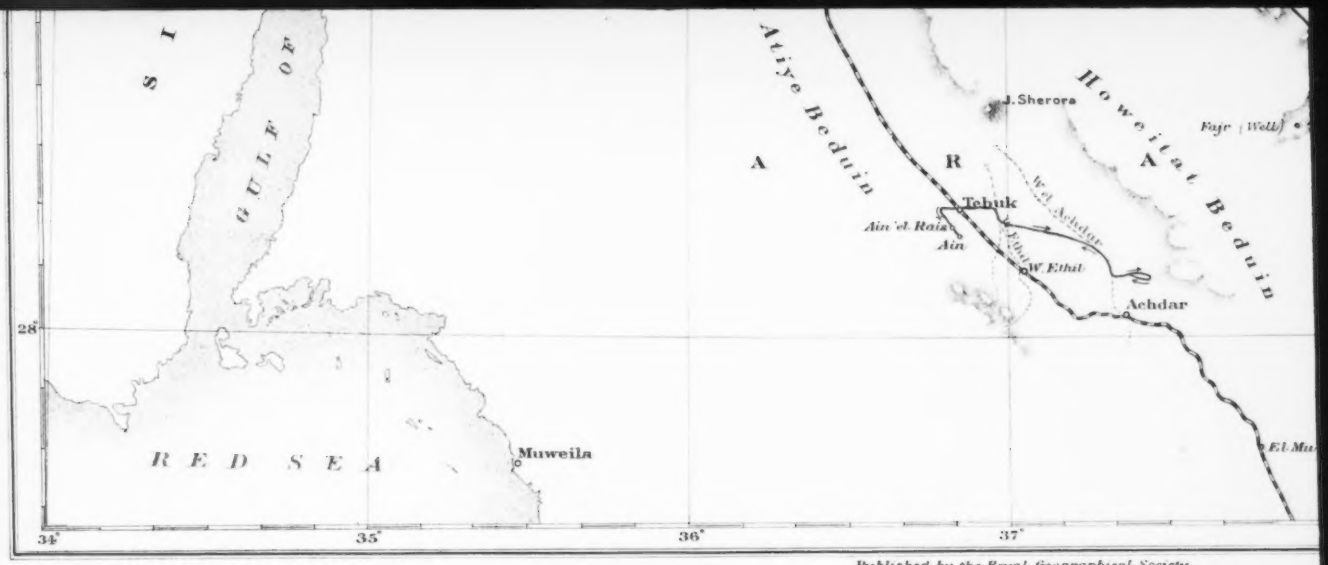
The expedition during which these photographs were taken was described in the *Geographical Journal* for January, 1908. They are reproductions of photographs which appear in Dr. Workman's book on the journey, bound in a separate album.

(1) On a projecting rock buttress of Pinnacle peak, at altitude of 23,000 feet; (2 and 3) Camp at Sonemarg; (4) At the porter's camp-fire; (5) On the march, Sind valley; (6) Women-zamindars, Ladakh; (7) First view of Nun Kun from the Suru valley; (8) Washing day in camp at Suru; (9) Highest Nun Kun peak; (10) Mate and Suru coolies at base camp on Shafat glacier; (11) Lama lambardar and women of Tazi Tonzas; (12) Fording Suru river; (13) Shafat nala and lower 3 miles of Shafat glacier; (14) Large moraine-covered hillock forced up by pressure at the junction of West branch with Shafat glacier; (15) Pinnacle peak, 23,300 feet; (16) Part of base camp, 15,100 feet, Shafat glacier; (17) Interior of tent at base camp, Shafat glacier; (18) Z1 from Shafat glacier; (19) Ice-fall branch of Shafat glacier and peaks at its head; (20) Panorama east from summit of D41; (21) Ice-fall on Ice-fall branch of Shafat glacier; (22) Climbing a sérac on Ice-fall glacier; (23) Nieve penitente, wind-conditioned variety, on Shafat glacier; (24) Highest Nun Kun peak, and White Needle peak; (25) Camp Nieve Penitente, 17,657 feet; (26) First view of White Needle camp, 19,900 feet; (27) Telephotograph of the White Needle; (28) White Needle camp, looking east; (29) White Needle camp at base of ice-wall; (30) Camp Italia, 20,632 feet, on Nun Kun plateau; (31) Camp Italia, looking south-west; (32) A slant which would have to be climbed in ascending highest Nun Kun peak from plateau; (33) Highest Nun Kun peak; (34) Ascending a sharp snow-slant; (35) Camp America, 21,300 feet, at head of Nun Kun plateau; (36) At the base of a broken ice-wall; (37) A projection on Pinnacle peak, showing gradients; (38) Peak Mer, 23,264 feet; (39) Panorama east from summit of Mount Nieve Penitente; (40) View from summit of Pinnacle peak; (41) Pinnacle peak, southern face; (42) Breakfast at camp Italia; (43) Upper 3 miles of Shafat glacier; (44) A nieve penitente pinnacle; (45) Nun, or Ser, 23,449 feet; (46) Termination of Ganri glacier in ice-precipice at Suru river; (47) High lateral moraine of Ganri glacier; (48) Crevassed and broken upper part of Fariabad glacier; (49) North-west nala, as seen from spur of Z1; (50) Stone cairn marking site of base camp; (51) View of Zaskar peaks; (52) Tongue of Fariabad glacier; (53) Tongue of Z1 glacier; (54) View east down North-West nala from glacier at its head; (55) On North-West col, 17,397 feet; (56) Barmal La; (57) Barmal camp on Barmal La; (58) Panorama of reservoir of Shafat glacier; (59) Barmal glacier; (60) Mount Nieve Penitente from Sentik La; (61) Part of dangerous ice-wall that has to be climbed on ascent of Mount Nieve Penitente; (62) On summit of Mount Nieve Penitente, 19,080 feet; (63) Bird's-eye view of North-West nala; (64) D41, 20,571 feet; (65) On summit of sharp rock-apex of D41; (66) View west down Barmal glacier; (67) View south from shoulder of Peak No. 10 on Bhot Kol glacier; (68) Final descent from the Barmal La to the Barmal glacier; (69) The Sentik La from Sentik glacier; (70) Telephotograph of D41; (71) Sunlight and shadow at noonday; (72) Patches of *névé*; (73) *Névé* ridges; (74) Flat-topped nieve pinnacle; (75) Avalanche bed on Hispar glacier; (76) Panorama of south-western half of Nun Nun plateau; (77) Nieve penitente on bed of snow avalanche; (78) Serrated avalanche penitente; (79) View at sources of Hispar glacier at 17,000 feet; (80) Nieve penitente, subsidence variety; (81) Wind-conditioned nieve penitente; (82) Thin *débris*; (83) Glacier table on lower portion of Biafo glacier; (84) Glacier-table penitente pyramid; (85) Glacier table; (86) Glacier-table nieve pyramids; (87 and 88) Thick detritus, mud-covered nieve penitente; (89) Mud-covered nieve pyramid; (90) Sand-covered penitente pyramid; (91) Lacustrine or composite nieve penitente; (92) Sérac penitentes, both large and small.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.


34°
35°
36°
37°
32°
31°
30°
29°
MEDITERRANEAN
SEA
PALESTINE
Jaffa
JERUSALEM
Bafe
DEAD SEA
Bahr Lut
Belka
Jesi
Dabba
Khan Zebib
Wm Nasur
Beni Sakhr Beduin
3350
Katrane
Wad Ghudar
W. Mheiwir
Wakf es Suwan Ridge
W. Thurwa
Region of Basalt
W. Awsaji
2500
J. Thleithuwath
Wadi Beyer
2400
J. Arrha
Northern Limit
Wells & ruined Khan of Bayer
J. Metaha
3100
Hamad
or
Ard es Suwan
Limestone Plain
covered with black flints
Gharamil Khinsir
3000
Wadi Hesa
Wadi Beyda
W. Hadbi
W. Tlaih
Hauza well
W. Schabi
W. Ghoreir
Depression
3100
3600
2600
J. Itbaik
abt. 4000
Sherrarat Beduin
2800
Mghairah
3000
Petra
Maan
Howeitat Beduin
Batn el Ghaul
Tuba
Wadi el Araba
Gulf of AKABA
SINAI
Beni Atiyeh
J. Arriatain
J. Harra
J. el Karmé
W. Rajil
Jebel Arguban
J. Tsokra
Kaf°
J. Garaja


38°
39°
40°
32°
31°
30°
29°
Sketch Map of
NORTH WEST ARABIA
Showing the explorations by
DOUGLAS CARRUTHERS
1909.
Scale 1:2,000,000 or 1 Inch = 31·56 Stat. Miles
10 0 10 20 30 40 50 60
Railways open
Author's route
Note.
No definite locality can be given for the names of Beduin Tribes, owing to their constant migrations. The Tribal names are placed on this map in the regions they were at the time of the journey.
This map is based on Prismatic Compass Traverse.
Heights in Feet from Aneroid readings.
J. Garaja
J. Mabiya
Jebel Misma
J. el Shedad
Nugrat el Hathatha (Salt)
Jebel el Methaha
Wel Ain
Weisit
J. Hammamiat
Khinsir
J. Zhereimez
J. el Shaiba
J. Zhedwa
Roala Beduin
J. Aghara
El Jauf-el-Amir
Shaab Rumman
Bseitn
(Plain of Basalt)
Jebel Tawil
2500
W. Wuaf
Hills of Wa'la
Ijala Hills
Beduin
Mghairah (Wells)
3000
2600
2300
Imleih (Wells)
Huj Umkur
Huj (Well)
Roala Beduin
Sand Dunes



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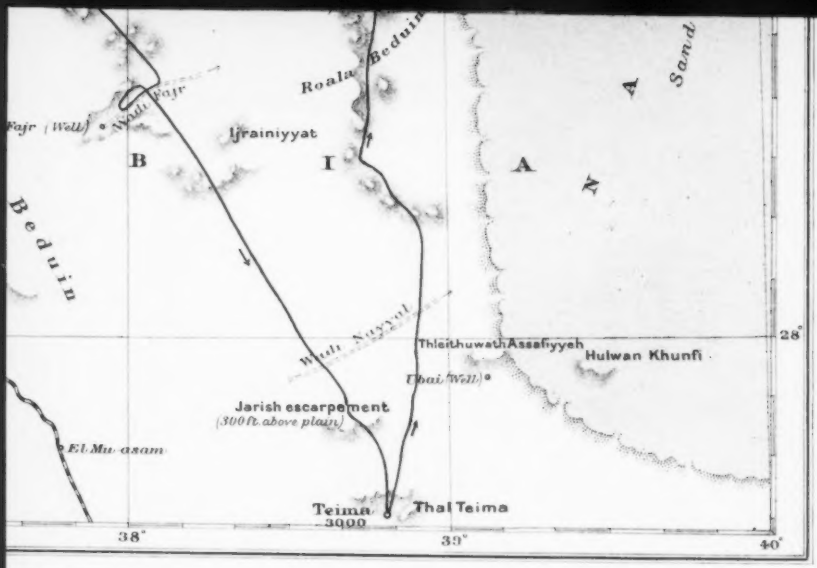
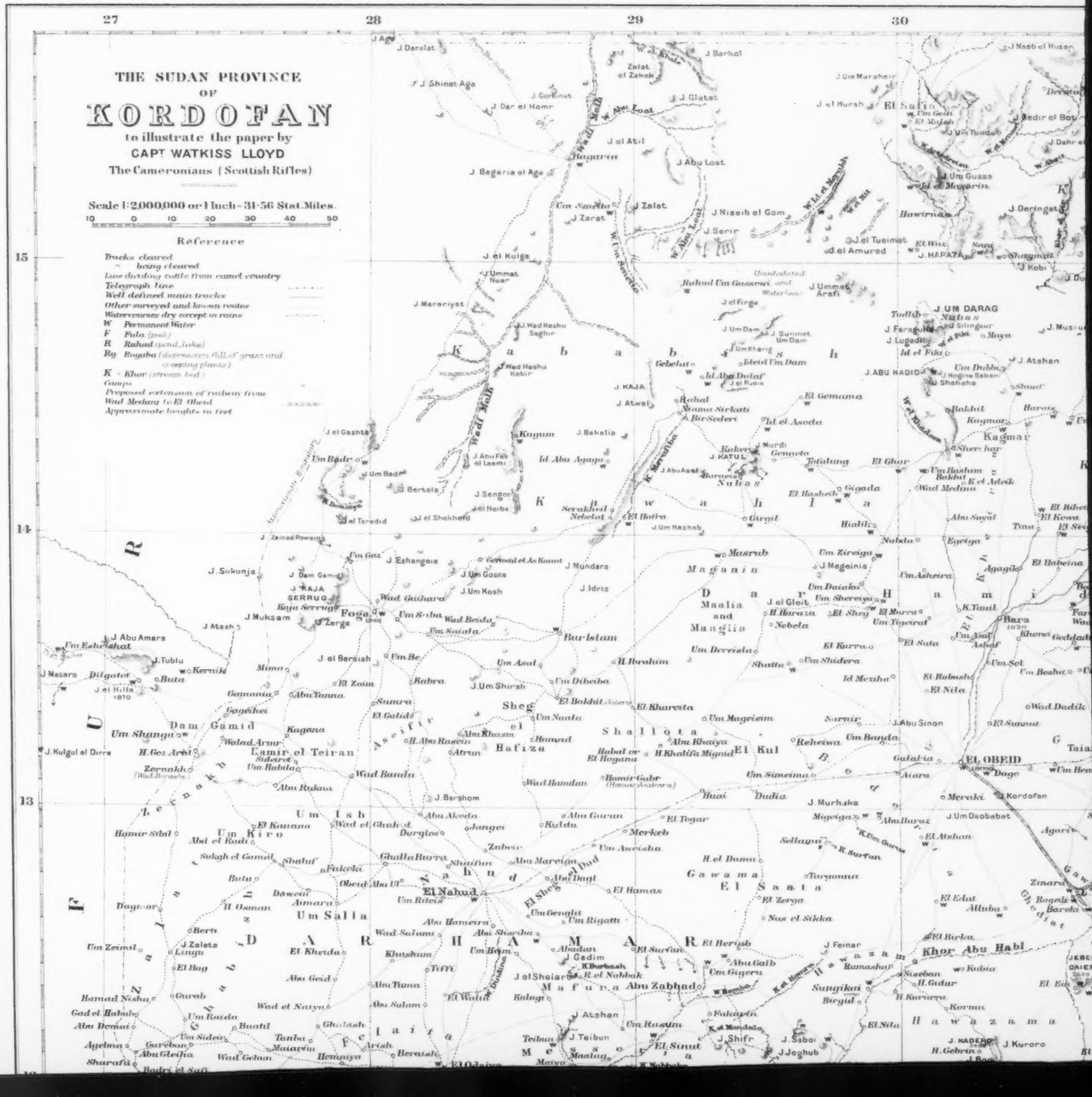
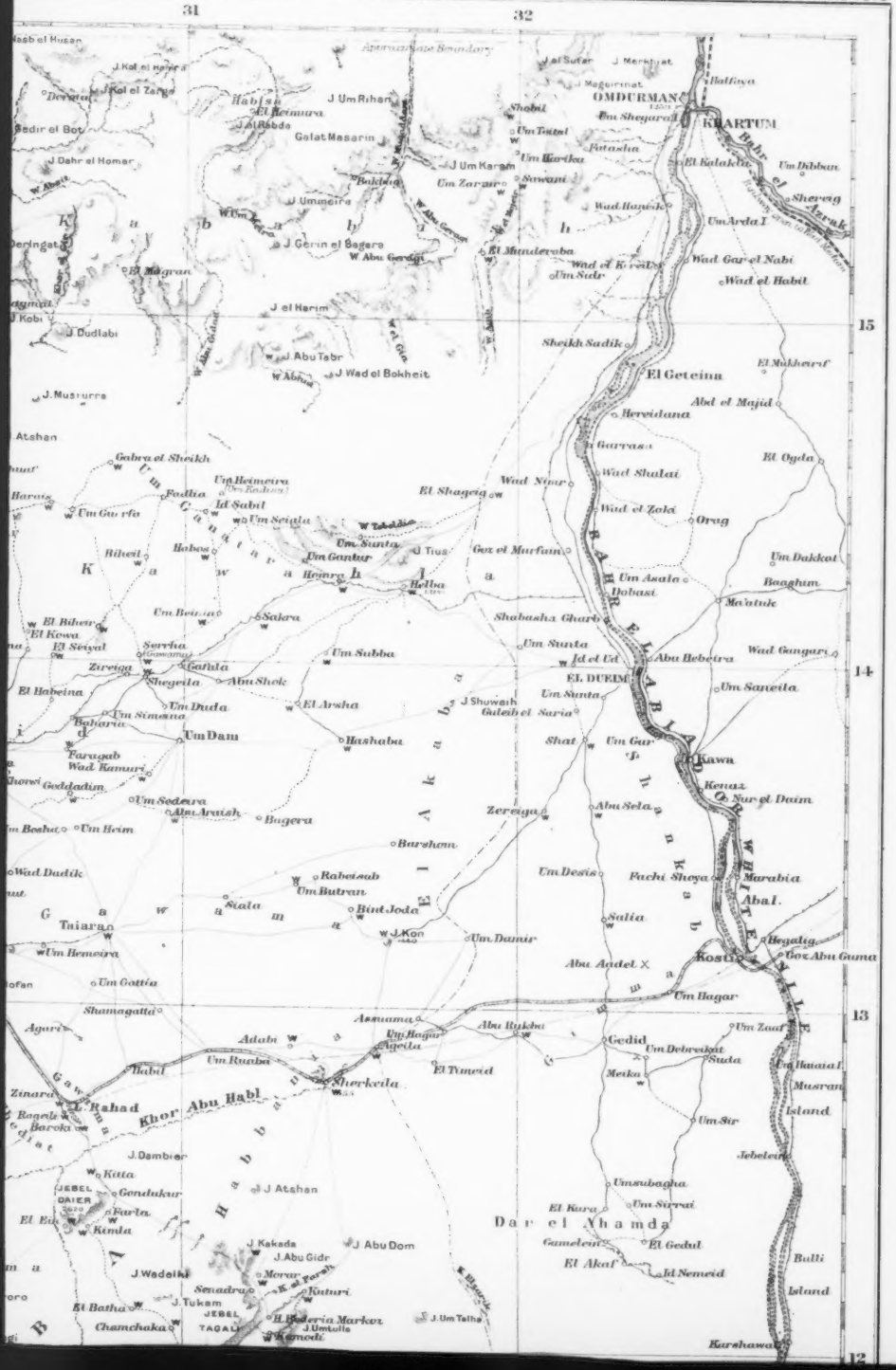
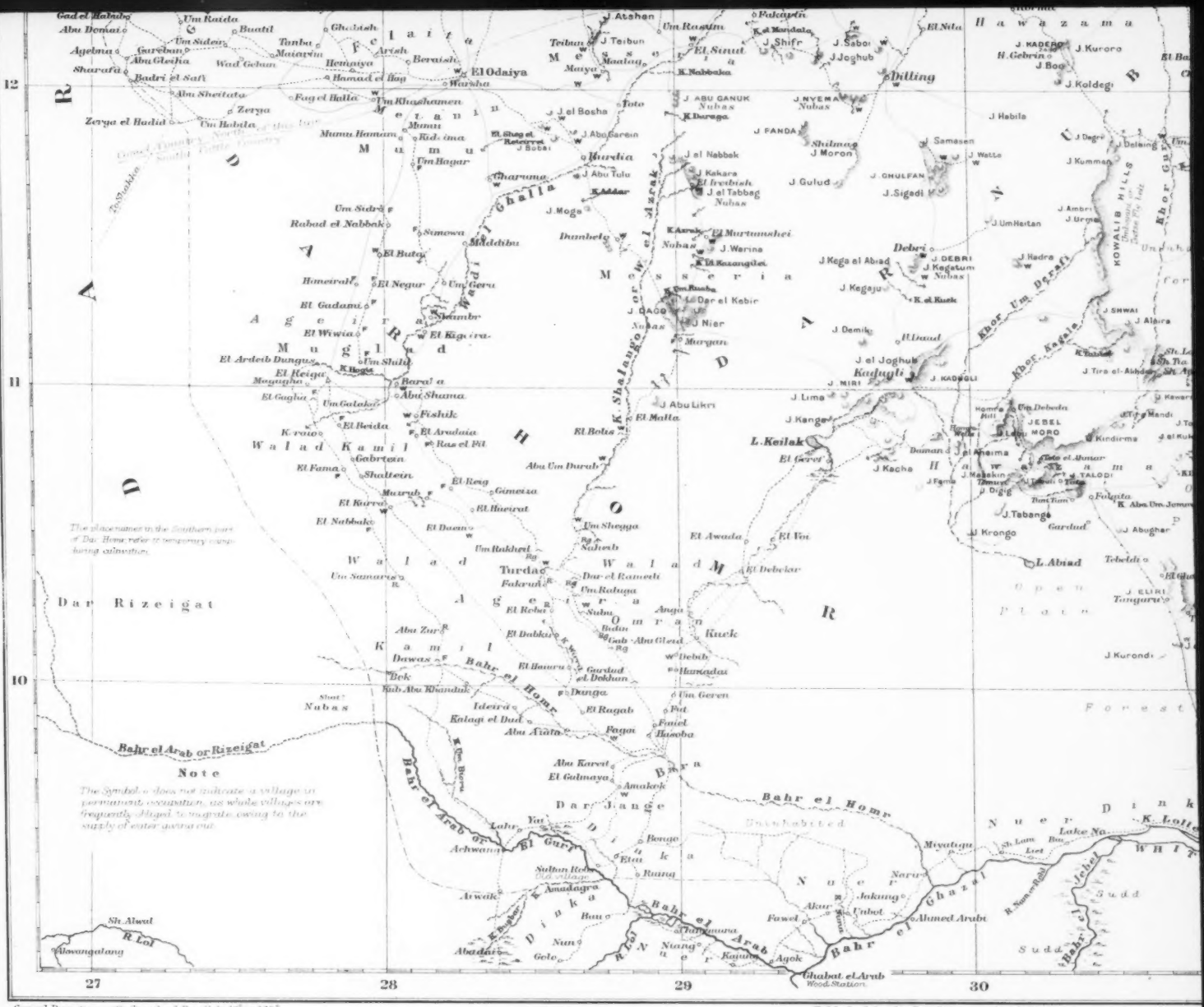

Roala Beduin
Sand
Wadi Fajr
Fajr (Well)
Ijrainiyyat
B
I
A
A
Beduin
Wadi Nayyal
Thleithuwath Assafiyyah
Hulwan Khunfi
28°
Thai (Well)
Jarish escarpement
(300 ft. above plain)
El Mu'azam
Teima
3000
Thal Teima
38°
39°
40°


THE SUDAN PROVINCE
OF
KORDOFAN
to illustrate the paper by
CAPT WATKISS LLOYD
The Cameronians (Scottish Rifles)
Scale 1:2,000,000 or 1 Inch = 31·56 Stat. Miles.
10 0 10 20 30 40 50
Reference
Tracks cleared
" being cleared
Line dividing cattle from camel country
Telegraph line
Well defined main tracks
Other surveyed and known routes
Watercourses dry except in rains
W Permanent Water
F Fula (pool)
R Rahad (pool, lake)
Rg Rugaba (depression full of grass and
sometimes plants)
K Khor (stream bed)
Camps
Proposed extension of railway from
Wad Medani to El Obeid
Approximate heights in feet
27
28
29
30
15
14
13
J Ago
J Darelat
J Barkot
J Shinat Aga
J Gordinat
J Dar el Homr
J el Atil
J Bagaria el Aga
J Abu Loat
J Zalat
J Nasib el Gom
J Serir
J el Tueimat
J el Amurad
J HAFAZA
J el Kulga
J Ummat Nuer
J Maraciyat
J Wad Hashu Saghir
J Wad Hashu Kebir
J el Gashta
J Um Badr
J Um Bado
J Bersela
J Sengor
J el Neiba
J el Shekherd
J el Taradid
J Zainad Rowana
J Sukunja
J Dam Gamid
J KAJA SERRUG
J Muksam
J Atash
J Abu Amara
J Tublu
J Masara
J el Hilla 1870
J el Bersiah
J Kulgul el Dirra
J Um Shorba
J Um Goska
J Um Kosh
J Idris
J Um Shirsh
J Mundara
J Eshangola
J Zerga
J Atwal
J KAJA
J ABU HADID
J Um Dam
J Um Kheirig
J Lugadit
J Feragulla
J Silingaor
J Musrur
J Atshan
J Um Dubba
J Shahsha
J Bakhit
J Um Hashim
J el Adak
J Gegada
J Um Hashab
J Abu Asal
J KATUL
J Abu Fas el Laami
Um Badr
Um Gaz
Um Be
Um Saiata
Um Kaiata
Um Asal
Um Dibeiba
Um Naala
Um Mageisam
Um Simeima
Um Rigatt
Um Hom
Um Rasam
Um Gagera
Um Ritesi
Um Zeimat
Um Raida
Um Sidein
Um Gleifia
Um Shanga
Um Kiro
Um Salla
Um Ish
Um Daiaka
Um Shereiya
Um Tugeirat
Um Asheira
Um Zireiga
Um Derreiba
Um Shidera
Um Gebaba
Um Ashaf
Um Sol
Um Banda
Um Daobabat
Um Ruaba
Um Ashera
Um Gaiti
Um Gura
Um Awerasha
Um Ghalla Burra
Um Hamera
Um Sharaba
Um Ghalaga
Um Tegar

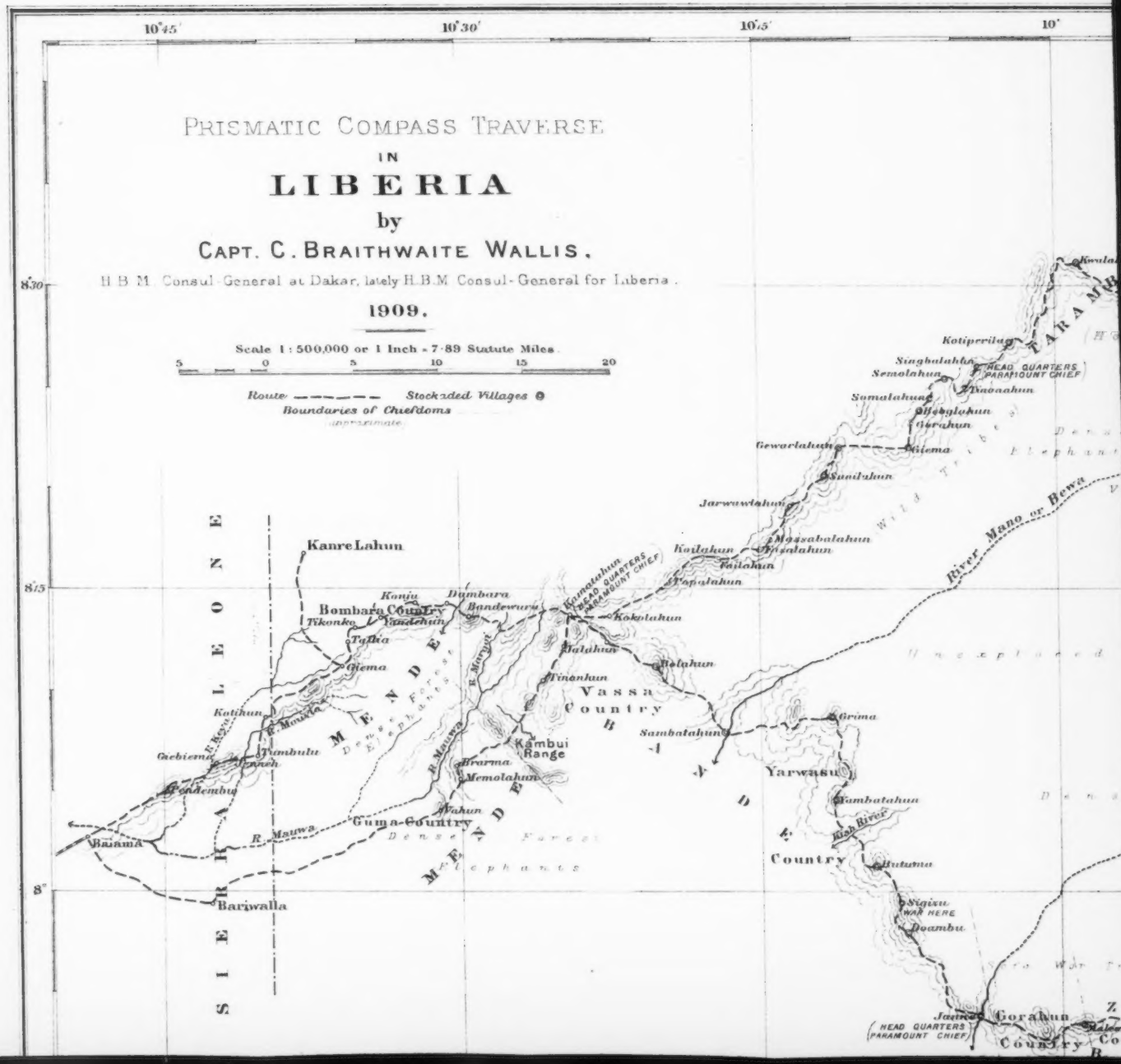
KORDOFAN.

Lloyd.


31
32
15
14
13
12
OMDURMAN
KHARTUM
Blue Nile
Atbara
El Geteina
Abd el Majid
Herveidana
Wad Shalai
Wad el Zaki
Orag
Um Asala
Dobasi
Shabasha Gharb
Um Sunta
Id el Ud
Abu Hebeira
EL DUEIM
Um Sameita
Kawa
Kenaz
Nur el Daim
Abu Sela
Marabia
Abal.
Kosti
Um Hagar
Gedid
Um Debreikat
Suda
Musran
Island
Um Sir
Jebelein
Umsubagha
Um Surrai
Dar el Nhamda
El Gedul
Bulli
Id Nemeid
Karshawal
Um Dakkot
Baaghum
Ma'atuk
Um Zaad
Abu Rukba
Um Desis
Fachi Shoya
Um Damir
Abu Aadel X
Goz Abu Guna
Hegaig
Salia
Um Gar
Shat
Hashaba
Um Dam
Bugera
Zereiga
Burshum
Rabeisab
Um Butran
Bint Joda
Siala
Taiara
Um Remeira
Um Gottia
Shamagatti
Asmuma
Um Hagar
Ageila
Adabi
Um Ruaba
Habil
Sherkeila
El Tomeid
Rahad
Khor Abu Habl
Gawasa
Zinara
Baroka
J. Dambier
Kitta
Gendukur
JEBEL DAIER
Farta
Kimla
El Batha
Chamchaka
J. Tukam
Senadra
J. Wadelki
J. Kakada
J. Abu Gidr
J. Abu Dom
J. Atshan
Habila
Um Gantur
Um Santa
Um Seiala
Um Beimera
Fadlia
Id Sabil
Um Gurfa
Gabra el Sheikh
Atshan
J. Musrurra
J. Dudlabi
J. Kobi
J. el Harim
Abu Tabr
J. Wad el Bokheit
Sheikh Sadik
El Mukherif
El Ogda
Wad Gangari
Wad Gar el Nabi
Wad el Habit
Um Arda I
Shereg Anrak
Wad Hamdok
Um Sadr
El Mandereba
Wad el Kerail
J. Gerin el Bagara
El Magran
Abu Gerdga
Um Zarzur
Sawani
Bakkiba
J. Um Karam
Um Karaka
Patasha
El Kalakla
Um Dibban
Shabil
Um Shegara
Um Tutul
Galat Masarin
J. Um Rihan
El Remura
J. el Rabde
Habisa
Derwan
J. Kol el Zarga
J. Kol el Hamra
Bedir el Bou
J. Dahr el Homar
Jebel Daier
Um Gurfa
Um Gantur
Um Santa
Um Seiala
Um Beimera
Fadlia
Id Sabil
Um Gurfa
Gabra el Sheikh
Um Subba
Sakra
Um Beimera
El Biheir
El Kowa
El Seiyal
Sarrha
Zereiga
Gahila
Abu Shok
Shegeila
El Habeina
Um Duda
Um Simsma
Baharia
El Arsha
Um Dam
Hashaba
Farageb
Wad Kamuri
Geddadim
Um Sedeira
Abu Arish
Bugera
Um Heim
Um Boaha
Wad Dadik
Rabeisab
Um Butran
Bint Joda
Siala
Taiara
Um Remeira
Um Gottia
Shamagatti
Agueir

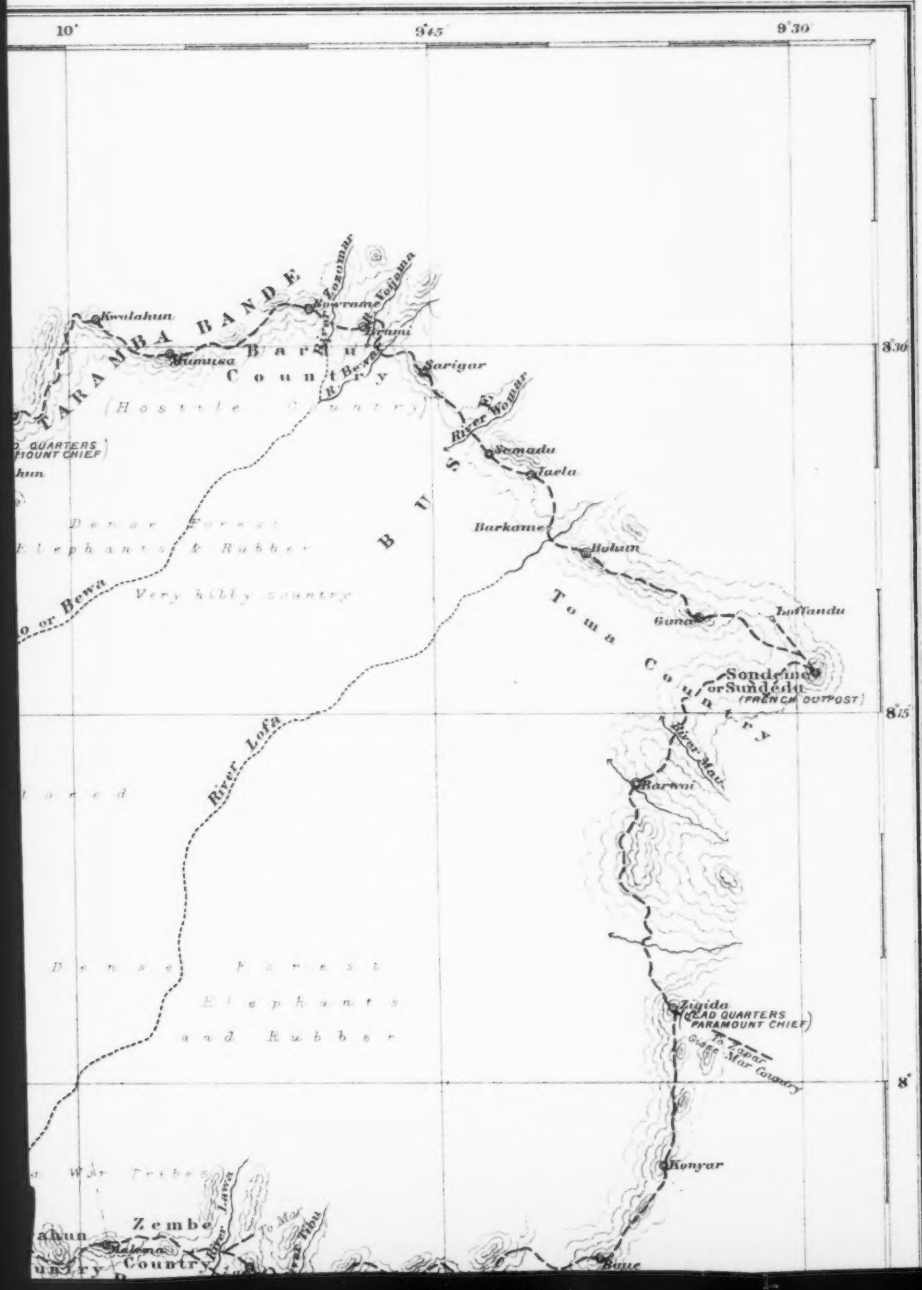

Note
The Symbol ○ does not indicate a village in permanent occupation, as whole villages are frequently shifted to migrate owing to the supply of water running out.
The place names in the Southern part of Dar Hamr refer to temporary camping cultivation.
Dar Rizeigat
Baḥr el Arab or Rizeigat
Baḥr el Homr
Baḥr el Arab
Baḥr el Ghazl
Kh. Shalanko
Khor Um Dafaf
Khor Angela
Khor Lau
Khor Adar
Kowalib Hills
Jebel Sudd
Lake No
L. Keilak
L. Abiad
Wood Station
Ghabat el Arab
Published by the Royal Geographical Society
Conical Projection with Standard Parallels 10° and 15°
12
11
10
27
28
29
30

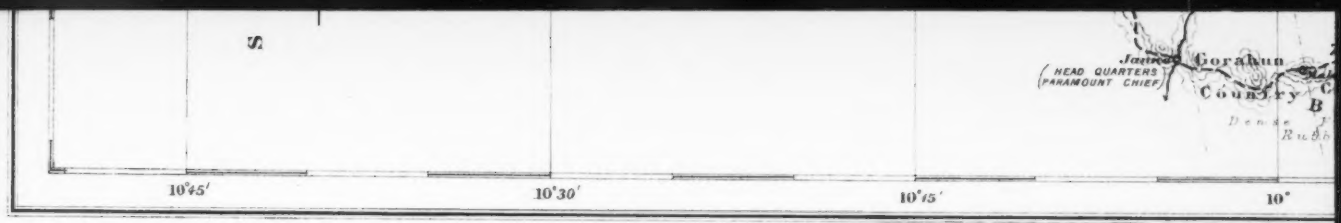
J. Abu Gidr
J. Wadelkai
Mavar
Katuri
Senadrao
J. Tukam
El Batha
Chanchaka
JEBEL TAGALI
H. Bedouria Marker
J. Umbolla
Kamoch
J. Um Talha
El Akaf
El Nemeid
Island
Kurshawal
12
J. Tuchok
J. TAGO
Fellata
J. Abu Shok
Delaing
Um Berembeita
J. Koloro
Waland Forest
Renk
Agang
Khor Gu
KOWALIB HILLS
Unhabited forest
J. TARDIK
Nubar
J. Ongul
J. TURUM
J. Kurun
Um Bedeida
Minadak
Kolang
Anok
Tereiba or Atal
Um Zuga
K. Nadlu
Hameid Forest
K. Joghan
Sh. Latura
Sh. Tia
St. Apaura
K. Um Idara
K. Dabdab
W. Taulu
El Sheg
Senagul
11
J. Kawarma
J. Errio
J. Girada
Magarum
Gelbek
Birkat Rao
Um Enegba
Um Gursean
Atarak
Alcarwen
Fajak
Uriang
Ageir
Melut
Jeng Yom
Gio
Wenrewal
Bentemma
Tedao
Abaatt
Wantaw
Ranjachak
Atara
Wanakwoch
Obul
El Tama
10
KODOK (FASHODA)
Golbang
Lul
Bel
Ogod
Wau
Malwal
Pawera
Gogvira
Dunjol
Shilluk
Malakal
Obwa
Awarajok
Taufikia
Nagdia River
Gnok Sobat
Abwong
Ashel
Lajak
Shot Ajik
Golgak
Abujok
Dem
Malwal
Mashar
Tenga Sharga
Emdiama
Obua
Nigela
Nigiwag
Rerbot
Nebeda
Rihaniyah
K. Lolle
Tonga
Shilluk
Dinka
Bahr el Zeraf
Noi
J. Zeraf
K. Atar
White Nile
Open Plain
Plain covered with forest
Approx. limit of forest
Villages
Kurondi
Tanguru
Tiro
Tekeem
J. ELIRI
J. el Amira
J. el Gird
J. el Ahmar
El Gheibush
J. Abughar
J. Werna
J. El Fo. I
J. Fungor
Safa
Sahab
Nyaro
El Shag el Hajar
Kim. Sunn
K. Abu Um Jemmud
J. Morung
Kh. Bura
Kh. Mirgi
Kh. Kaka
Kh. Kia Kaka
Kh. Adar
31
32


10°45'
10°30'
10°15'
10°
8°30
8°15
8°
PRISMATIC COMPASS TRAVERSE
IN
LIBERIA
by
CAPT. C. BRAITHWAITE WALLIS.
H.B.M. Consul-General at Dakar, lately H.B.M. Consul-General for Liberia.
1909.
Scale 1:500,000 or 1 Inch = 7·89 Statute Miles.
5 0 5 10 15 20
Route
Stockaded Villages
Boundaries of Chiefdoms (approximate)
SIERRA LEONE
LIBERIA
Kanre Lahun
Bombara Country
Kanju
Dumbara
Bandewuru
Tikonko
Kandahun
Tallia
Giema
Katihun
R. Moa
R. Mauwa
Grebiema
Tambulu
Kpanch
Bendembu
Bauma
Bariwalla
Mende Forest Elephants
Guma Country
Dense Forest
Elephants
Kambui Range
Brarma
Memolahun
Wahun
R. Mauwa
R. Moru
Kanadahun
HEAD QUARTERS PARAMOUNT CHIEF
Kokolahun
Kalahun
Nilanhun
Vassa Country
Sambatahun
Kotiperilun
Singbalahun
Semolahun
HEAD QUARTERS PARAMOUNT CHIEF
Tinoahun
Samatahun
Gerahun
Gewerlahun
Giema
Sundahun
Jarwawlahun
Kailahun
Tailahun
Topolahun
Mazzabalahun
Nilalahun
Holahun
Tinankun
Yarwasu Country
Grima
Tambatahun
Bah River
Butuma
Nigiau
WAR HERE
Doambu
Jawaia Gorahun
HEAD QUARTERS PARAMOUNT CHIEF
River Mano or Bewa
Unexplored
Wild Tribes
Dense Forest
Elephants

LIBERIA

WALLIS





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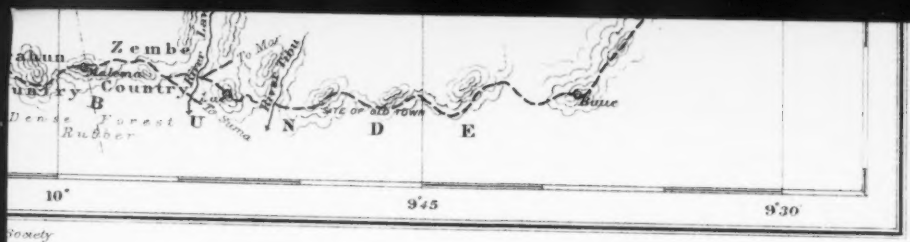

Society